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Lidgerwood's Improved Elevator Engine.

The engraving upon this page represents a hoisting engine designed more particularly for operating elevators, either for passenger or freight purposes. It is made by the Lidgerwood Manufacturing Company, 96 Liberty street, New York. The bedplate is cast in one piece, and of a form best calculated to secure great strength without unnecessary weight.

By securing the cylinders to the frame in the manner shown, a direct connection of the valve motion is obtained; also a free escape of all water of condensation from the cylinders, which are covered with Russia iron jackets. The cylinder heads are of cast-iron, neatly finished. It will be observed that the locomotive plan has been adopted in the style and arrangement of the crosshead and connecting rod.

The guide is a single bar having broad wearing surfaces. The crosshead is provided with brass gibs, easily adjusted to take up wear.

The connecting-rod brasses are fitted up and secured by a strap, square-ended gib and key equal in every respect to the best locomotive work. The pillow blocks are of large proportions, and lined with babbitt metal. The drum is of cast iron, and of large proportional diameter, with the face grooved to receive a wire rope. The gear at the end of the drum is of the ordinary spur type, and double, to secure smooth running.

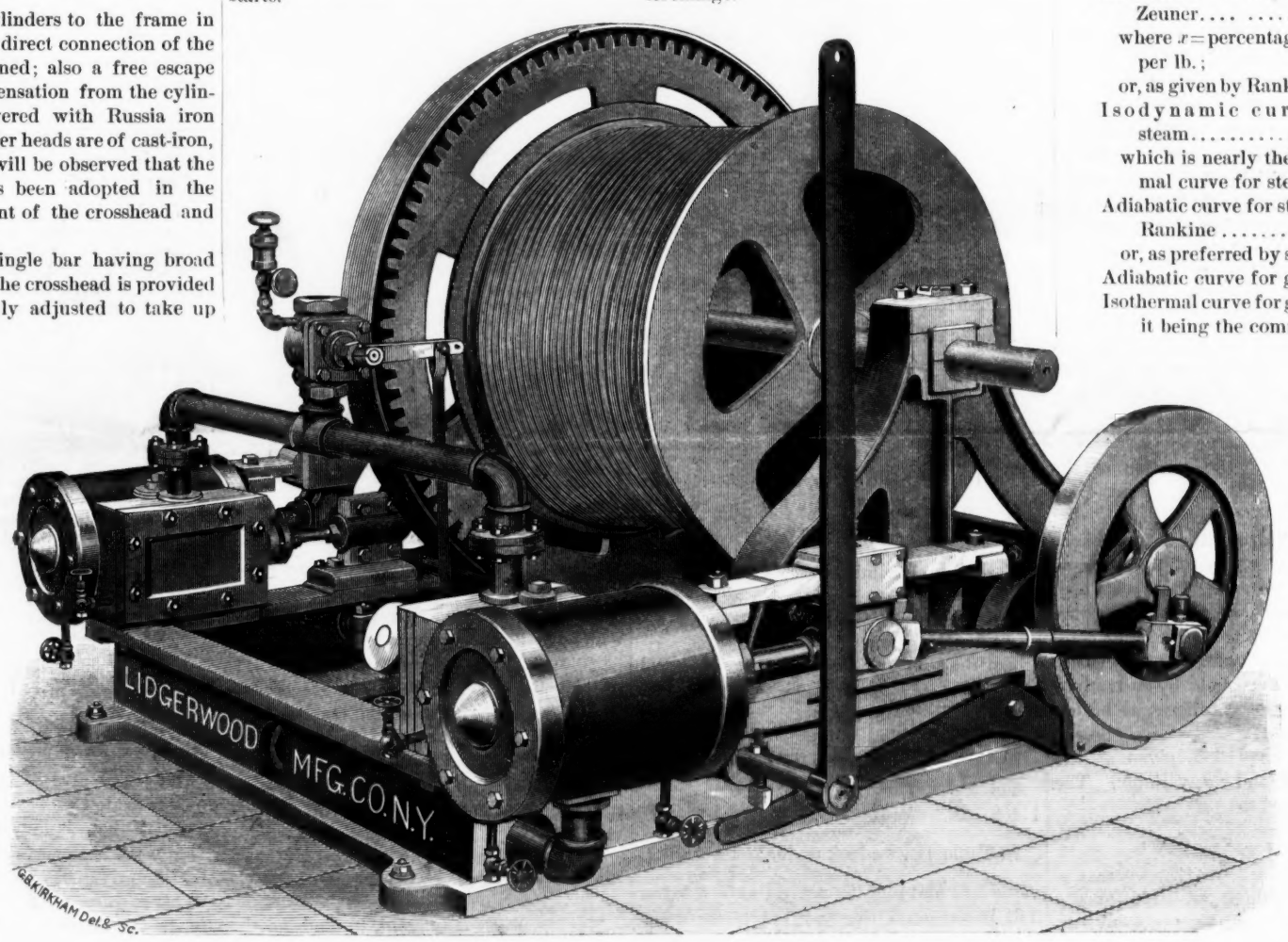
These gears are cast from metal patterns cut in a gear-cutter, which insures accurate castings and quiet operation. The ratio of one gear to the other is about 10 to 1. The link motion is of the usual locomotive style, with the link blocks attached to jaws upon the ends of the valve rods.

The ordinary D slide valves are used, they being the most simple and easy to keep in repair.

The chief trouble experienced by the parties building this engine, as well as other builders, in using the old-style link motion as a reversing gear, has been the very unsteady motion of the drum, and a consequent unpleasant jerking of the car. This trouble is caused by leaving the throttle valve wide open, and depending entirely upon the position of the links for starting and stopping the engines.

This is a very wasteful process, as more or less steam is sure to escape through leakage. By an ingenious combination of the throttle valve and links, this jerking motion has been successfully overcome in this engine, and an entirely smooth motion attained. When the links are at mid-gear the throttle is closed; but when they are moved either side of the center, the throttle is opened in proportion to the position of the link.

At full gear forward or back the throttle is opened wide. With this arrangement those acquanted with elevator engines will readily perceive that, the throttle being opened gradually, effectually prevents the sudden or jerking motion of ths engine as it starts.



NEW ELEVATOR ENGINE.

The throttle valve used is of a special design, and made particularly for this class of work. A friction brake is placed under the face of each of the crank wheels, to be brought into contact with them as required.

These brakes are provided with their independent means of adjustment, so that they may be relied upon for holding any load the engine is capable of hoisting.

The engine can be placed in any convenient location near the hatchway, and connected to the chains or wire rope generally used for operating the car.

The links, throttle and brakes are all automatically operated by the movement of a single upright lever, shown in the engraving, to which the chain or rope for operating is attached.

These automatic arrangements are positive in their action, unless some part should break, which casualty is not likely to occur, as the parts are amply strong to meet all contingencies. Piston rods, link pins, crosshead and crank pins, as well as the valve rods and stems, are all of steel. The cylinder and other parts are provided with ample means of lubrication, as well as for adjustment to take up lost motion. The gears are covered by a shield to prevent accidents. These engines are made in five sizes, from eight to forty horse-power, with or without boilers and fixtures, as required. All engines built by this concern are tested in actual service before leaving the shop. All parts are made to gauge, by the quantity and will interchange.

Running the Adiabatic, Saturation and Other Steam Curves.

BY S. W. ROBINSON, PROF. MECH. ENG., OHIO STATE UNIVERSITY.

In steam engineering the strictly theoretical curves required in theoretical determinations are quite complex, as expressed by their mathematical equations. The equation of the common hyperbola referred to its asymptotes, and of the adiabatic curve for gases, have a comparatively simple form, and mathematicians have taken these as suggestions of like simple curves for steam, which shall at least approximate to the truth. To this end we have an abundance of high authority for the equation

$$pv^n = p_1 v_1^n = \text{constant; or}$$

$$\frac{p}{p_1} = \left(\frac{v_1}{v}\right)^n$$

as being sufficiently accurate for many cases in practice, for the relation of the absolute pressures and volumes in expanding steam.

The exponent n is given different values for different conditions of action. For instance, for the common hyperbola, $n=1$, an exceptionally easy curve to draw on the drawing-board without computation, and to which curves of steam expansion are often referred.

For the saturation curve of steam,
Rankine ..... $n=\frac{17}{16}$
or as preferred by some, $n=1.0646$
Adiabatic steam expansion,
Zeuner..... $n=1.035.+1x$
where x = percentage steam per lb.;
or, as given by Rankine, $n=\frac{10}{9}=1\ 1111$
Isodynamic curve for steam..... $n=1.0456$
which is nearly the isothermal curve for steam.
Adiabatic curve for steam gas,
Rankine ..... $n=1.3$
or, as preferred by some, $n=\frac{4}{3}=1.3333$
Adiabatic curve for gases, $n=1.408$
Isothermal curve for gases, $n=1$,
it being the common hyperbola.

To lay out these curves on a drawing, co-ordinates may be computed and the values laid off. An approximate construction is given by J. H. Cotterill (see his steam engine, page 340), where computations are avoided. An instrument is said to be known for drawing the adiabatic curve, though it is but little, if at all, in use.

But some more available method seems desirable fo drawing the curves, especially when examining indicator diagrams for working up steam tests.

By drawing all these curves through one point on the same diagram, they will be found not to deviate very far from each other, though yet too far to take one for another in careful reductions. In looking at such a diagram of lines, the suggestion is to use the common hyperbola for a reference line, because easily drawn; and from this to lay off small quantities or corrections for plotting the other lines. But when tables of values of co-ordinates exist, the curves may possibly be laid off directly with greater satisfaction. A convenient method was given for this in the AMERICAN MACHINIST for December 16, 1882. An example is also given on the *saturation curve* for steam, though it is erroneously stated to be for the adiabatic curve. The quantities there treated are given in the first two columns below.

TABLE 1.

Absolute Pressures lbs.	Relative Volumes for Saturation Curve.	Adiabatic Curve.	Common Hyperbola.
23	122	122	122
50	58.3	60.6	56.1
83	26.5	38.4	33.8

But had the author of that article used a table of values for the adiabatic curve instead of for the saturation curve, the former would have been realized. But tables for the adiabatic curve are not common, the reason being probably in the fact that the value of n for this curve is so uncertain, it being even made variable by Zeuner, as above indicated.

To take advantage of the above suggestion of including the principal part of the abscissas under the common hyperbola, and of calculating corrections to lay off from it to give the other curves, we are led to inquire for easy ways of laying out the common hyperbola, and for obtaining the corrections. If in this we succeed in placing the curves within 1 or 2 per cent. of their true positions without logarithmic calculations,—indeed by simple mental operations,—a service will possibly be rendered.

In the first place to construct the hyperbola, an admirable method is given by Mr. Wm. Lee Church in Dec. 16, '82, of the AMERICAN MACHINIST. Another method which has been much used by the writer is also convenient. It is given in works on Analytical Geometry. In Fig. 1. reckon the absolute pressures upward from the horizontal line through O; and the absolute volumes from the vertical line through Θ, to the right. An hyperbola is dotted in. Suppose a be any point on an indicator card. Another point, c, may be found on the same hyperbola through a by laying off $c\ d = a\ b$ on the same line. From any one point a, any number of points c may be thus found on the same hyperbola, &c. Now suppose we wish to refer the initial and terminal expansion of an indicator card to the hyperbola. Let a be the terminal expansion, place a straight-edge or stretch a thread through from a, to near the initial expansion. Then holding this line temporarily, open the dividers to the space $a\ b$, and transfer it to the other end of the line $d\ c$. Then c is a point on the hyperbola. If c is not exactly where needed, move the straight-edge a little and plant another point c, &c. Pratically, when 3 or 4 points, c, are noted, a pencil may be run through them, giving the portion of the hyperbola required, all occupying part of a minute.

Some engineers judge of the steam action, leakage of piston, valves, &c., by a simple reference to the hyperbola. Then what here follows could be dispensed with, but the more fastidious will probably wish to compare with other curves, which can be easily laid off from this hyperbola by correction, or difference quantities as follows, as hinted by Cotterill, page 341.

Differentiate the equation given at the outset, regarding n, and $v\ a$, variable. The result can be reduced to

$$\frac{dv}{v} = \frac{dn}{n} \text{hyp. log.} \frac{v_1}{v} = \frac{dn}{n} \times k$$

in which v_1 is one volume, as, for instance, a Fig. 1 or 2, and v, the other, for any point as c; and k, a coefficient. The logarithmic part, or coefficient, k, may be tabulated, and becomes a convenient coefficient, or factor, for the second number of the equation, or for the quantity $\frac{dn}{n}$ which quantity is definitely known as soon as n is decided upon. For instance, take $n = \frac{1}{9}^0$ for the adiabatic curve, it being 1 for the common hyperpola. Then dn will be the difference of these values, or $\frac{1}{9}^0 - 1 = \frac{1}{9}$, and $\frac{dn}{n} = \frac{1}{10}$.

If the coefficient were 1, then the correction dv would be a tenth of v.

More definitely, suppose in Fig. 2, $OB = v_1$ and $OA = v$; then the correction is $ce = \frac{1}{10}\ OA$, for the values just named.

The values for the coefficient, k, are given in the table II:

To illustrate the use of these tables, suppose $a\ c$, Fig. 2, to be the hyperbola of reference (the common hyperbola), with $B\ a = 23$ lbs., $A\ c = 83$ lbs., in absolute pressures; and OB, the volume 122. Then the volume OA, will be 33.8 for the common hyperbola.

Hence for $v_1 = 122$, and $v = 33.8$; $\frac{v_1}{v} = 3.61$.

II. TABLE OF COEFFICIENT k.

$\frac{v_1}{v}$	k	$\frac{v_1}{v}$	k
1.1	.095	3 3	1.194
1.2	.182	3 4	1.224
1.3	.262	3.5	1.253
1.4	.336	3.6	1.281
1.5	.405	3.7	1.308
1.6	.470	3.8	1 335
1.7	.531	3.9	1.361
1.8	.588	4.0	1.386
1.9	.642	4.2	1.435
2.0	.693	4.4	1.482
2.1	.742	4.6	1.526
2.2	.788	4.8	1.569
2.3	.833	5.0	1.609
2.4	.875	5.5	1.705
2.5	.916	6.0	1.792
2.6	.955	6.5	1.872
2.7	.993	7.0	1.946
2.8	1.030	7.5	2.015
2.9	1.065	8.0	2.079
3.0	1.099	8.5	2.140
3.1	1.131	9.0	2.197
3.2	1.163	9.5	2.251
		10 0	2.303

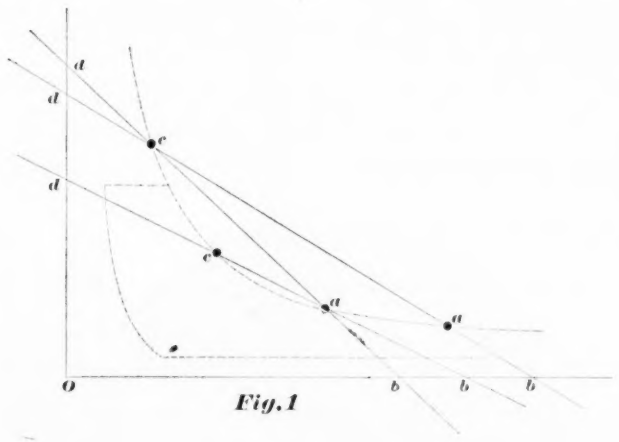


Fig. 1

III. TABLE OF VALUES OF $\frac{dn}{n}$.

For the saturation curve, $n = \frac{1}{17}$, and $\frac{dn}{n} = \frac{1}{17} = .0588$.

For the adiabatic curve, $n = \frac{1}{9}^0$, and $\frac{dn}{n} = \frac{1}{10} = 0.1$.

For the adiabatic curve, $n = 1\ 035 - .1x$, and $\frac{dn}{n} = \frac{.035 - .1x}{1.035 - .1x}$.

For the isodynamic curve, $n = 1.0456$, and $\frac{dn}{n} = \frac{.0456}{1.0456} = .0436$

For the adiabatic steam gas, $n = 1.3$, and $\frac{dn}{n} = \frac{.3}{1.3} = .2308$.

For the adiabatic gases, $n = 1.408$, and $\frac{dn}{n} = \frac{.408}{1.408} = .29$.

In Table II., we look under $\frac{v_1}{v}$ for the value 3.61 and find the nearest to be 3.6, but 3.61 is one-tenth the way over toward 3.7. Consequently we look for that value of k, which lies one-tenth the way from 1.281 toward 1.308, and obtain $1.284 = k$. For k, this answers for all the curves.

Now in Table III. we find, for adiabatic expansion of steam,

$$n = \frac{10}{9} \text{ and } \frac{dn}{n} = 0.1$$

consequently

$$\frac{dn}{n}\ k = 0.1 \times 1.284 = .1284 = \frac{dv}{v}$$

The correction is therefore

$dv = v \times .1284 = 33.8 \times .1284 = 4.9 = c\ e$, Fig. 2. This added to the volume $c = OA$, gives

$$v + dv = 33.8 + 4.9 = 38.7 = fe,$$

a value which differs less than 1 per cent. from the computed value 38.4 in Table I.

As a second case, suppose the expansion be according to the saturation curve, when by table III.

$$\frac{dn}{n} = \frac{1}{17}$$

Then

$$\frac{dn}{n}\ k = \frac{1}{17} \times 1.284 = .0745$$

and $dv = v \times .0745 = 33.8 \times .0745 = 2.86$. This added to the volume v gives

$$v + dv = 33.8 + 2.86 = 36.7$$

a value which differs but slightly from the calculated value 36.5 at the foot of the second column of table I.

In these calculations we observe that the volume v, with which to multiply, and to which to add, is the one which is to be corrected, viz.: in this case we seek the correction $c\ e$, Fig. 2, and hence the volume v is to be taken as AO.

But the rule may be applied the other way. That is to say, we may make c the point of intersection of the two curves, and correct the volume BO. In that case k is to be found as before, and given the contrary sign. In fact the whole quantity $\frac{dn}{n}\ k$ will be the same as before, except for the contrary sign; if the volumes on the common hyperbola are the same, viz.: 33.8 and 122. But in this calculation we should multiply by the volume BO, because the correction is for this volume. That is, the correction is $122 \times .1284 = 15.7$

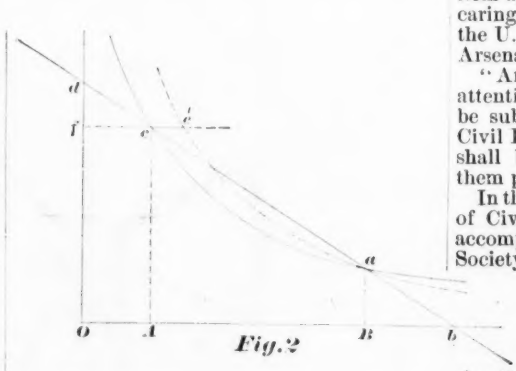


Fig. 2

for the adiabatic expansion, a quantity which, by the accurate method, is found to be 16.6; differing by less than one per cent. of the value of BO to be corrected. For the saturation curve the correction is $122 \times .0745$, &c.

For these calculations, a simple rule might be given for those who prefer to have the rule expressed in words instead of symbols, viz.:

RULE

For Constructing any Steam Curve Approximately.

Having given one point, to find another on any particular steam curve, draw a common hyperbola through the first point, and horizontal lines through both points; these lines intersecting the hyperbola. Divide the greater by the lesser volume and find the corresponding k from Table II. This k multiply by the proper value for the steam action as found in Table III. This product is a small quantity which must be multiplied by the volume to be corrected, giving the correction itself. This correction add to the volume to be corrected; or lay it off on the horizontal line through the second point.

Or again, Fig. 2:

Given the pressures Ac and Ba, and the volume BO. Draw the hyperbola as described through a, it being the full line ac. Divide BO by AO and look in Table II. Take the k opposite and multiply by proper value from Table III. This result multiply by AO, and we have the correction ce, on the horizontal line through c to give a point e on the curve, which will correspond to the value taken from Table III. Any number of points may be thus found, even beyond the point a.

For points beyond a, the correction is subtractive instead of additive; and multiply tabular quantity by the greater instead the lesser volume; that is, by the volume to be corrected.

Let us apply the first rule to correct the hyperbolic volume 56.1, to the adiabatic volume 60.6, for pressure 50 lbs. absolute; the final volume and pressure being 23 lbs. and 122 respectively.

Dividing greater by lesser volume we get $\frac{122}{56.1} = 2.175$. For this ratio of volumes we find k from Table II. to be $k = .777$. For the present adiabatic expansion, Table III calls for $\frac{1}{10}$ giving .0777. Multiplying by the volume 56.1 gives the correction 4.47. Adding this to the volume 56.1 to be corrected, we obtain $56.1 + 4.47 = 60.6$; or, in this case, exactly the value given by the logarithmic calculation of Table I.

Appropriations for Testing Metals.

We have just received from the Chief of Ordnance of the War Department, Washington, D. C., a circular letter in regard to tests of metals on the Emery testing machine at the Watertown Arsenal, to which is appended a letter from the President and Secretary of the American Society of Civil Engineers addressed to the first named public functionary, which gives a programme for the tests.

The circular letter, which we reproduce entire below, presents a provision of law which (not having been brought to our attention before) is somewhat astonishing to us, as we believe it will be astonishing to most of our readers:

The last Army Appropriation Bill, in the item appropiating ten thousand dollars "for caring for, preserving, using and operating the U. S. Testing Machine at the Watertown Arsenal" provided as follows:

"And the Chief of Ordnance shall give attention to such programme of tests as may be submitted by the American Society of Civil Engineers, and the record of such tests shall be furnished said society, to be by them published at their own expense."

In the furtherance of this object the Society of Civil Engineers have addressed to me the accompanying letter. I concur fully with the Society in the terms of their programme, believing them to be most equitable, in view of the small appropriation now available.

If parts and pieces, free of cost, are placed on board of some transportation line, and sent to the Watertown Arsenal, Watertown, Mass., at the lowest rate of freight, &c., &c, furnishing this office a statement of the composition of the metal and the process of manufacture, &c., this department will pay the freight, test the pieces, account for scrap, furnish early reports to the sender, and to the Society of Civil Engineers for publication.

We have always supposed that tests of metals made by the Government at the expense of the people were made for the information and benefit of the whole people and that no private society of engineers was, by right, entitled to receive the record of results to the exclusion of other societies, the newspaper press and citizens who belong to no society of the kind. We have nothing to say against the American Society of Civil Engineers. It is a highly honored and useful body, but we contend that its few hundred members have no more rightful claim to a proprietory interest in the official record of tests of materials made at public expense, than any other engineers, mechanics or citizens of any occupation. If tests are to be made at the expense of the people, the Government should publish the results and furnish copies to the newspapers and all engineers' societies, to engineers, mechanics, public libraries and others most interested, to the extent of the number of copies published. This is the programme pursued in reference to most Government matters published for the use of citizens.

In regard to the programme of tests, it is probable that the A. S. of C. E. would furnish a very good one, but programmes submitted by other engineers or societies of engineers, according to the provision of this act, may be rejected by the Chief of Ordnance without notice, but it *is* charged that he "shall give attention to such programme of tests" as may be submitted by the one society.

The A. S. of C. E. does not furnish its publications to other than its members free. Nobody has a right to expect a society to give away papers published at "their own expense."

According to usual custom, the papers are copyrighted, and cannot be reproduced without permission of the owners of the copyright. We must rely upon the magnanimity of the A. S. of C. E., to allow the records of tests to be published by such newspapers as desire to give them publicity without paying a royalty for the privilege; but in the name of the tens of thousands of engineers and mechanics in the country who do not belong to the A. S. of C. E., we protest against any further appropriations of the people's money for making tests of metals with such an unjust provision adhering to its expenditure.

The programme for tests is as follows:

PROGRAMME.

Congress has appropriated the sum of ten thousand dollars for "caring for, preserving, using and operating the United States Testing Machine at the Watertown Arsenal" for the fiscal year ending June 30, 1883.

In order to produce the largest immediate results with the small amount appropriated, we suggest that the investigation be limited this year to the compression members of structures, and that co-operation be invited from railroad companies, bridge engineers, architects, manufacturers and users of structural material strained in compression.

For this purpose we suggest that the Ordnance Department of the United States Army should offer to pay the freight on and to test duplicate compression members, either from structures which such parties may have in progress of construction, or special shapes prepared for this purpose, provided the same be furnished free of further cost.

If the parties will cause to be manufactured one or more duplicate compression parts from each bridge or structure which they may undertake hereafter, or will furnish special shapes, varying in proportions, preferably in series from twenty to sixty diameters, and varying by increments of five diameters; or if they will manufacture special shapes which they desire to have tested; if they will also furnish at least three small or hand specimens of the same material, prepared as indicated in the note below;* if they will place these parts and pieces, free of cost, on board of some transportation line, obtaining the lowest available rate of freight to Watertown Arsenal, and notify the Chief of Ordnance of the particulars of shipment, also furnishing, so far as they can, a statement of the composition of the metal and its process of manufacture, and a diagram showing the position the member is intended to hold in the structure, and the computed strain it is expected to bear, that then the Ordnance Department will:

1. Pay the freight on the shipment from the initial point to Watertown Arsenal.
2. Test the compression pieces in due course, as well as the hand specimens.
3. Account to the shipper for the value of the scrap, if required, when the same is sold, or return the same to the shipper, if preferred, paying the freight from Watertown.
4. Furnish the shipper an early special report of results of the tests of all pieces sent by him, giving him an opportunity of sending a second piece to cover any defects that may have occurred.
5. Furnish the American Society of Civil Engineers promptly, for publication and distribution, full copies of all tests and information obtained therefrom.

*These three or more small or hand specimens to be of the same material as the compression member furnished; to be rectangular, and to be reduced to one-half of one square inch in area of section; to be of the same thickness as that used in the construction of the member, unless that thickness should exceed one inch, in which case the small specimen is to be reduced to one inch.

It is desired as far as practicable to shape these specimens from pieces of the same section as those composing the member, preserving the surfaces as they come from the rolls, excepting the removal of the outer scale.

The length of these specimens should be two feet.

According to foreign journals a Swiss engineer, named Fodor, at present employed on a railway in Finland, has lately perfected a discovery which, if all that is said of it be true, will prove an immense boon to railway companies. The invention consists of an indicator, of easy application to all existing wagons and locomotives, whereby their speed, the number of stoppages they make, the duration of the stoppages, and the times at which they are made, are exactly and automatically registered. The apparatus has been tried and its efficiency proved on a railway in Finland, and on a part of the line between Moscow and St. Petersburg.

Large Universal Grinding Machine.

The large grinding machine shown herewith has been designed for grinding a variety of work of too large dimensions to admit of its being done by the ordinary or small grinding machines. This one is being made by the Brown & Sharpe Manufacturing Company, Providence, R. I. Its general features are embodied in the smaller machines made by this concern, inasmuch as nearly all kinds of straight or tapered work can be ground thereon. This machine has a capacity to take work up to 14″ in diameter and 6″ long.

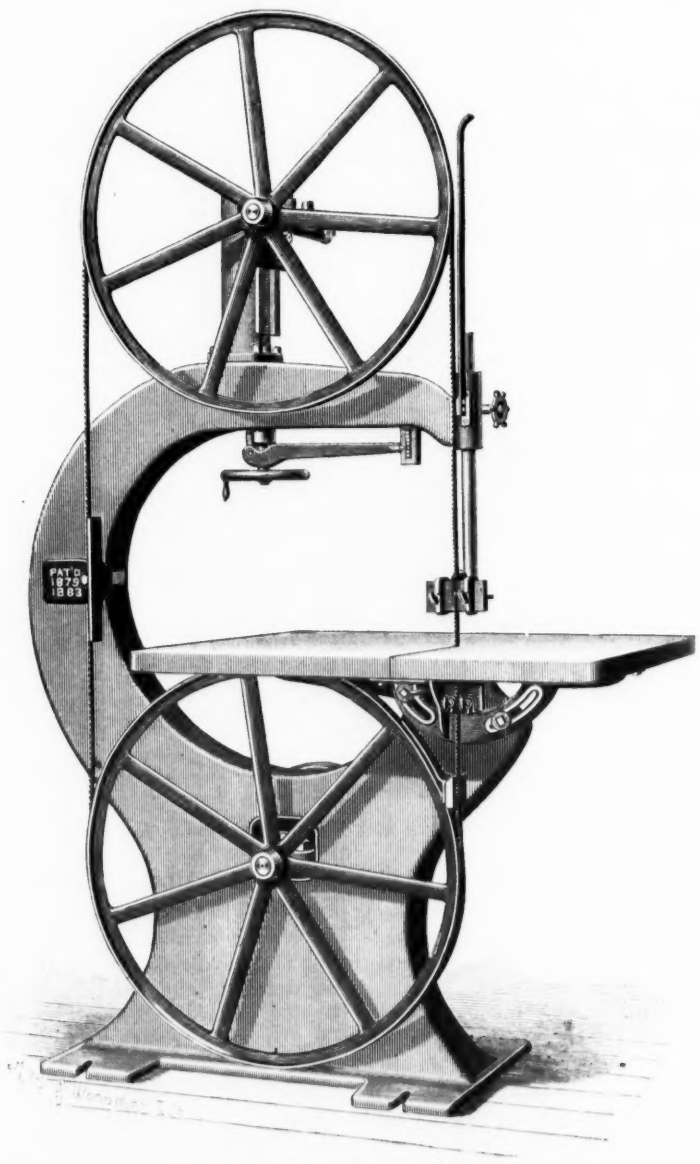
LARGE UNIVERSAL GRINDING MACHINE.

The bed is supported upon two bases, forming closets for the small parts and fixtures belonging to the machine. It has upon its top surface a table, to which the head and foot stocks are clamped at all distances apart. These stocks can be moved about a central pivot, for the grinding of tapers. This table has its top surface inclined toward the back of machine, for the purpose of conducting the water used in grinding toward a channel on the bed, from which it is carried off by a waste pipe. The head has a graduated base, and can be turned at all angles. The foot-stock spindle is fed forward by a screw, but has in addition an arrangement of a spring to accommodate all expansion of the work caused by heating.

The emery wheel stand base can be set at all angles, the wheel being fed forward by a hand wheel, shown in front of the machine while so adjusted.

The emery wheel, which is 18 inches diameter by 1 inch thick, is driven by two 1¾ inch belts. The work can be ground either upon fixed centers, being driven by a pulley which revolves upon one of them, or the spindle can be revolved and work held in a chuck. The spindle journals are of steel hardened, and separately ground.

The emery wheel journals are hardened, ground, and have adjustable boxes to compensate for wear. The proportion of bearing surfaces subject to wear has been very much increased upon this machine, which will greatly increase its durability. These surfaces are all accurately scraped to a bearing, and are well protected from injury by dust and emery. The overhead work for this machine consists of a countershaft, with drum and tight and loose pulleys. The weight of the machine is about 6,000 pounds. The requisite number of wrenches and other necessary small tools accompany each of the machines.



CLEMENT'S BAND SAWING MACHINE.

Clement's Band Sawing Machine.

A band saw is generally considered an indispensable adjunct to a pattern shop and other manufactories where large quantities of special and miscellaneous sawing is to be done. We present herewith a new band sawing machine, as made by F. H. Clement, 122 to 126 Mill street, Rochester, N.Y. This machine has several features that differ from the ordinary band sawing machine.

The frame is of a G shape and made of a single iron casting. A table of kiln dried cherry is securely bolted to a segment bar, by means of which the table may be inclined at any desired angle. The segment bar is planed true and square, to insure accuracy of adjustment as well as rigidity during operation. The iron wheels are of improved design, having concave arms with a T rim. Their faces are covered with pure rubber bands strengthened by canvas, which are strongly cemented to the wheels, after which they are ground perfectly true. Both shafts are of steel, the lower one having babbited boxes 6′ long, while the upper shaft has a single box 12″ long. All these boxes are adjustable.

It will be observed that the upper bearing is attached to a slide, so that it may be adjusted to produce the right tension upon the saw. A new straining device is used in this connection for securing an elasticity to the tension. Where both wheels are rigidly adjusted, being held in position by a screw, any expansion or contraction of the saw will cause it to slip or strain it beyond its power of endurance, thereby causing it to break. Some of the most serious accidents have occurred from the breaking of band saws, as they have a velocity sufficient to drive them through the clothing and limbs of the workman should it strike them right. The straining device attached to this saw is made with a view of preventing saws from breaking by being overstrained. Furthermore, after being adjusted it will preserve a uniform tension upon the saw. This device is simply a balance lever attached to the screw in front of the operator and shows at once the tension required for any particular sized saw.

The tension can be varied without extra trouble to suit either a very light or a very heavy saw. The saw is guided both above and below the table by hardened steel guides, but when preferred hardwood may be used instead of metal. These guides are adjustable and self-oiling.

The loose pulley has a self-oiling device, with a hub 7″ long. The machine here shown is a 37-inch one, each of the wheels being 37″ in diameter. It stands 8′ 3″ high, occupying a floor space 3′ 10″x5′ 4″. The table is 36″x42′ with a sawing space of 15″x36½″. The pulleys are 14″ diameter with faces 4½″ wide each. Length of saws are 19′ 9″ and the wheels run at a speed of 400 revolutions per minute. The weight of this machine all complete is about 1,250 pounds. A scarfing frame, tongs and one extra saw, with necessary wrenches, accompany each machine.

Our contributor, Angus Sinclair, of Cedar Rapids, Ia., writes us: "We are in the throes of a snow and frost blockade at present, and it is heaping endless work on an already overburdened round house foreman: so my articles on Locomotive Engine Running are, per force, neglected. I have not been able to write a line for three weeks." We trust the blockade will soon be broken, and that Mr. Sinclair will have opportunity to write, among other things, about his methods of overcoming the difficulties encountered on a frost bound railway.

Chas. T. Porter, the well-known engineer, has opened an engineering office in Room 42, Tribune Building, New York city. There is no doubt that he will have all the business he could desire.

A New Lathe Tool.

We illustrate on this page a new lathe tool now being introduced to the mechanical public by Pratt & Candee, Hartford, Conn.

The tool is secured in the tool-post of the lathe, and the work to be turned should be secured in a chuck at one end, and with jaw screw open the work is to be inserted between them and the jaw screw turned in just to a bearing, permitting the work to turn therein, and the cutter, No.2, is secured in the socket by its clamp-screw, as shown in No. 1. The cutter is made reversible, one end for a threading, cutting-off and turning tool, and the other end for squaring up. The cutter is moved up to and away from the work by the crank at the rear end.

For hand-tooling the cutter is unclamped from the socket and the tool rest, No. 3, inserted, and secured. If it is desired to turn from center, a male center may be made by the use of the chaser from the tool-rest. The male center may be inserted in a female center, the cutter, No.2, replaced, and the work turned up from center instead of from outer surface with the jaw screws turned out.

No. 4 shows the tool-rest with an indicator inserted, to be used in turning up various kinds of work on a face-plate.

When used for boring the cutting tool is removed, a boring tool is secured fast between the jaw screws, as in No. 5, and the cutter socket moved in against the rear end of the boring tool as an additional support.

In the manufacture of small taps the tool may be used as a starter from the screw of the lathe, and the tap afterwards completed by using the dies, thereby obtaining the correct number of threads to an inch, with accuracy.

It will thus be seen that this tool, when secured in a tool-post of a lathe, may be used for a great variety of purposes in operating and working metals, and that especially in operating upon rods of very small size, the liability of their springing while being cut or otherwise manipulated, is very much diminished, thereby insuring much greater accuracy, especially in small work. The tool was patented by D. D. Smith.

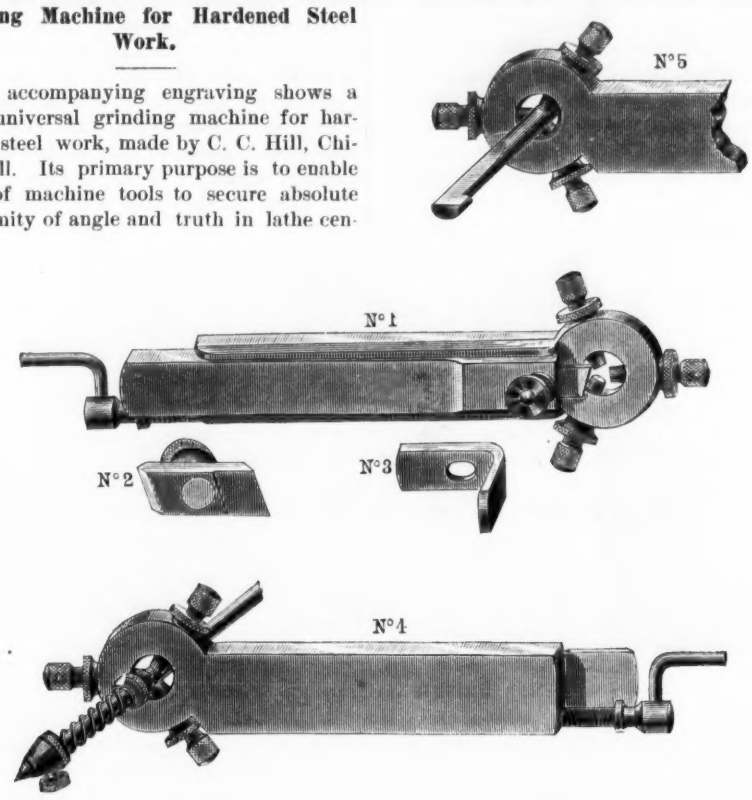
The New York *Times* says:

Recent experiments with the telephone in this city have shown that the instrument may be used over nearly if not quite as long circuits as the ordinary Morse apparatus. With a Hopkin's telephone and a completely metallic circuit, communication was freely held with Albany, the return wire making the distance traversed by the current a little over 400 miles. Another experiment will be tried Sunday by the Mutual Union over a circuit more than double the length, and it is expected that the same success will be achieved. This, however, though interesting from a scientific point of view, demonstrates nothing to further the practical value of the telephone, for there is abundant evidence that it is too sensitive to inductive influences, grounds, crosses, and leaks to be of good service or supersede the present system of communication. It is a curious fact that since its beginning the telegraph has been improved less than any other invention known. Years ago the recording instrument was supplanted by the "sounder," and no further improvements have since been made. It is true that the duplex and quadruplex have increased the working capacity of lines, but the instruments used to day do not differ a whit from those used a quarter of a century ago. In submarine telegraphy are employed the same swinging needle and mirror which interpreted the first signals flashed across the first cable. Batteries have been improved and methods of insulation perfected, but the main features of the invention have changed but little. The telephone is undoubtedly peerless for local work, and is reliable enough on short circuits to make it most useful as a servant to the general public, but over long distances it is more than probable the original Morse system will hold sway in spite of all the experiments which may be conducted. To any one who has tried to receive a telephone message when rain, snow, or induction had filled his instrument with dissipated bumble-bees and frying-pans the chief objection will be readily understood. Over the same wire and under the same conditions the Morse key, relay, and sounder would work without a break.

Cut straw is said to serve a better purpose in preventing hydrants from freezing than any substance ordinarily used.

Grinding Machine for Hardened Steel Work.

The accompanying engraving shows a small universal grinding machine for hardened steel work, made by C. C. Hill, Chicago, Ill. Its primary purpose is to enable users of machine tools to secure absolute uniformity of angle and truth in lathe centers, and to true up chucks of all kinds and sizes.



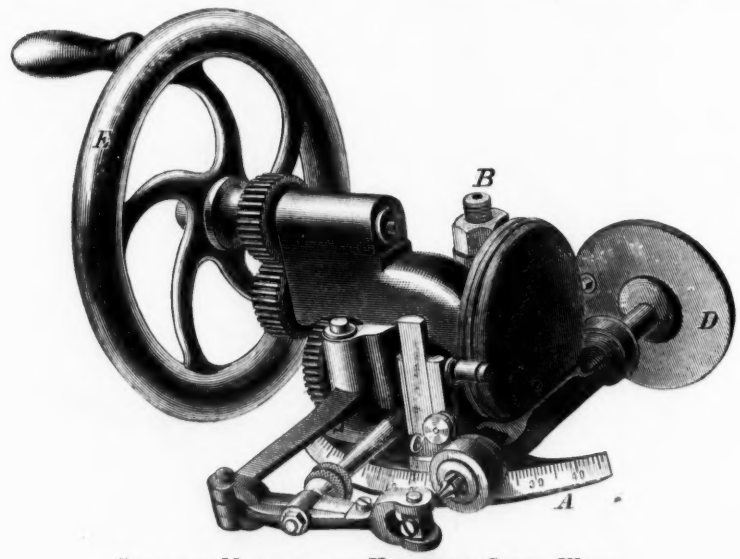
It is also adapted to the accurate grinding of cylindrical or conical surfaces (internal or external) reamers, gauges, milling-cutters, taps, etc.

The construction of the machine is fairly shown by the cut, and the operation will be readily understood from the following brief description.

For use, the machine is set upon a lathe in place of the tool-post, and securely fastened by tightening the bolt *B*.

To insure accurate alignment of the center of graduated arc *A* with the lathe centers, a contact piece is placed between the base-plate of the machine and the face-plate of the lathe at the time of tightening the bolt *B*.

When the base-plate has been properly adjusted and secured, the grinder may be rotated upon its center of arc until its reading (at *C*) indicates the desired degree of angle, then firmly fixed to the base plate by means of a clamping screw, not seen.



GRINDING MACHINE FOR HARDENED STEEL WORK.

By turning the crank the emery wheel *D* acquires a high rotative speed (5,000 to 6,000 per minute with moderate crank motion) and a slow traversing motion across the work. This traversing movement may, in a moment, be changed from 0 to 1⅞ inch or intermediate distances. The machine is built to rank with the best tool work, and is guaranteed accurate.

The main shaft is made of best tool steel, hardened and ground, and the bearings are furnished with compression bushings of same material also hardened and ground.

All parts liable to injury from dust or grit are protected by casings.

The machine may be run by hand or power; the former is preferable on short jobs, as one may often finish a set of centers or a mill in less time than would be consumed in setting *any* machine to run by power, if it be a portable one.

In connection with the elevators made by them, Clem & Morse, of Philadelphia, are introducing a new safety device. Beneath the floor of the elevator is a platform or false bottom, made of ⅝" pine, which is nicely balanced on light steel rods with sufficient spring to take off the weight. Beneath this vane or float, are two steel bars, carrying on each end toothed sprockets, and connected with the vane or float by toggle joints or links, in such a manner that, should the cable, belts, or any part of the machinery break, the resistance of air as the elevator falls, causes the float to rise instantly, which operation revolves the rod and sets the sprockets into either side of each post. This firm also have recently patented a vanishing worm, the object being to increase the bearing surface at center of worm, thus equalizing the area of wheel and worm.

A man erected some kind of a new-fangled pumping apparatus for a rancher at Paradise Valley. The pumping machine was to be driven by wind. The other day when a ten knot breeze was blowing, the inventor "turned her loose." In about half an hour the machine flooded the cattle corral with water, and floated away the butt end of a hay-stack. The ranchman yelled to his machinist: "Stop her! stop her!" but it happened that provision for stopping was what the inventor had not thought of. Had it not been that the well was soon pumped dry, the whole ranche would probably have been washed away. Even after the well was dry, the machine threw mud and gravel so wickedly that to approach it was unsafe.—*Virginia City Enterprise.*

Worcester is a noted machinery city, and it is in accord with the fitness of things that for mayor they should have a man who is connected with the machine industry. At the last municipal election Samuel E. Hildreth, of the firm of P. Blaisdell & Co., machine tool builders, was elected mayor, and has filled that office since January 1st. The citizens, especially the taxpayers, are well pleased with the way his administration opens, some real reforms having already been accomplished.

Improper Setting and Wedging of Chaplets.

BY THOS. D. WEST.

It is not uncommon to see castings lost from improper setting or wedging of chaplets. The work lost may be light or heavy. The little error that will cause the loss of a casting worth one dollar would cause the loss of one worth hundreds of dollars. In selecting this subject, there was no thought of presenting improved plans or ideas, but if possible to show how castings may be and are lost through want of care or judgment; not practice, for moulders that have worked a lifetime at the trade can be found who are no more expert, in this respect, than apprentices.

The mould chosen to illustrate this subject is a large piston; the number of cores in it is eight, and for each core there are three chaplets required, so that altogether we have twenty-four chaplets to be set and wedged, and should any one of this number be wrong, the result would be a bad casting.

Often there are moulds where the vent of some core can only be taken off through the bottom of the mould, and the core may be of such a form as to have only a small bearing on the sand and the rest on chaplets. This core may be the only one in a mould, to lose which would involve hundreds of dollars. When setting this core the moulder is very careful that the vent portion has a solid air-tight joint, for if the liquid iron should find its way between the joint of the core and mould all would be lost. After the core has been carefully set, the next important thing to be done, to insure safety, is after the cope is on, to wedge down the chaplets so that the head of iron cannot raise up the core, and allow the metal to get into the vent. At *B*, on the right-hand side of the cut, is an illustration of how a great many cores are dangerously wedged down. As this chaplet is shown, with its wedge and blocking, there are three things that could happen which would allow the core to raise up so that the iron could get into a bottom vent, as shown at *D*. It may be well to remark here, that whenever it is possible, vents in cores, similar to the one shown, should be arranged to be let off through the cope, as shown on the opposite side at *H*. There is always more or less danger in taking off the vent through the bottom. These remarks are intended more particularly for the draughtsman and pattern maker, who should always remember that in moulding there is generally more or less risk, and that they can very often greatly lessen this risk by having a little thought for the moulder's interests as well as for their own.

Going back to the subject; suppose the mould shown is being poured; the liquid metal is rushing through the runner or gate *A*, and the head soon becomes high enough to exert a pressure up and against the chaplets. Now look at chaplet *B*, and then at chaplet *K*. It would require but little experience to decide which one was liable to let the core raise sufficient for the iron to run into the vent *D*. Now the chaplet *B*, is by no means an exaggerated illustration, but a true sketch representing the way a great many chaplets are secured, sometimes on

jobs upon which a great deal of money and labor has been expended. The first noticeable weak point is at 2 Here we have only one point touching or resting on the core. This chaplet head may be stiff enough to stand as it now is, when it becomes heated, but if it does bend when the liquid iron makes it hot, up comes the core sufficiently to let the iron into the vent. Again, suppose the head will not bend; it is plain to see that in the way the wedge is placed in relation to the head which rests on the core, that it would not require a very great strain to tip over the top, so as to become loose from the wedge 3, thereby letting the core raise up. There is still another possibility of this core raising up. We will suppose that neither of the above results should occur, and that the chaplet will stay in the position shown. Over the top of this chaplet and wedge is a railroad bar. This bar is held down by having a wedge 4, placed between it and the cast iron beam *X*. Now the way this chaplet is placed to the outer edge, has been known to cause the rail, or similar bar, to partially roll over. Another feature frequently seen in wedging down the bars of a cope as well as chaplets is, instead of putting about an equal number of wedges on each side, they will all be placed on one side, and that most likely the weakest side.

As *S* and *T* may be seen, some very fair illustrations of the way many unaccountable bad results are accomplished.

A chaplet wedge, as shown at *S*, will often cause bad results. When a heavy pressure comes upon a chaplet thus wedged with cast-iron wedges (which are generally used), they will frequently break and allow the core to raise up and make the casting thinner than it should be, or allow the iron to run into bottom vents and cause a blow up.

The chaplet, *K*, is wedged in a way to be relied upon. After placing the wedges by hand, they need to be tightened. For this purpose a hammer should seldom be used. The hammering to tighten them should be done by some lighter article than the common run of shop hammers.

Some moulders will say the blocking and chaplets cannot always be arranged so as to use two wedges. It is admitted that there are often such cases; but, as a general thing, there is just about as much mechanical skill, or the lack of it, shown in placing the upper blocking as there is in the general handling of chaplets and wedges. Some moulders are just as liable to place blocking bars six inches above the chaplets as they are to have the bars clear only a quarter of an inch. The first blocks they can lay their hands on will be used to rest the bars on, instead of making a point to study the proper relation for careful wedging.

The less blocking and fewer pieces that can be used, the better it is for the wedging and for the safety of a casting. At *W* is shown a chaplet wedged with blocks in a reliable manner.

Careless moulders often lose castings by the way in which they set bottom chaplets. *R* and *M* show wooden blocks, having sharp-pointed chaplets driven in them. The block, *R*, is split, caused by using too long a chaplet. The block, *M*, shows the other extreme. Both of these blocks are liable to cause a bad casting through settling of the cores. Often, in setting a heavy core upon such chaplets, the weight will force the sharp points deeper into the blocks, thereby causing the core to settle and make the casting too thin. Perhaps if the core's own weight don't do it, the wedging down of the chaplets will.

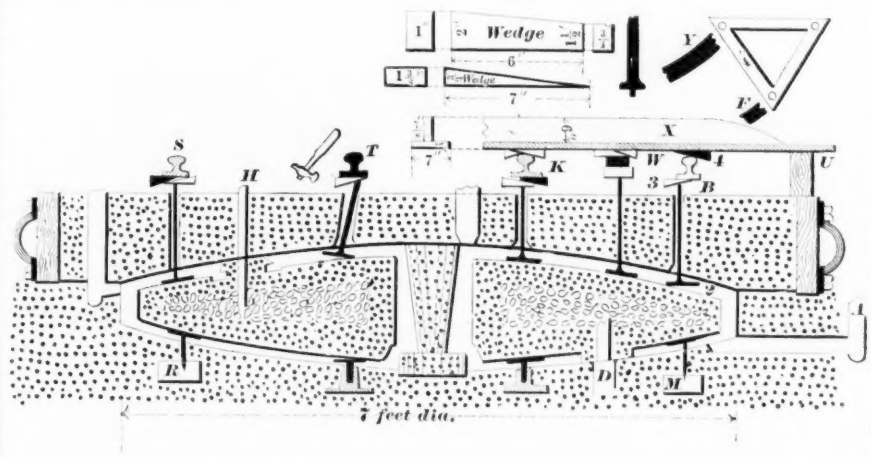
When wooden blocks are used, they are better if made of hard wood set with the grain up, and the moulder will have to use his judgment as regards the proper distance to drive in a point, as the size of the chaplet, the weight of core, and nature of the block must be considered. As a general rule, ½″ is a good distance.

The two inner bottom chaplets shown are placed in cast-iron stands. The chaplet on the right is reliably set. The one on the left illustrates why cores are sometimes broken by not having a solid bearing.

The wedges shown, having dimensions given, are of good proportions for cast-iron wedges for general foundry use. Many shops use wrought-iron wedges. Altogether, they are decidedly the best; but, on account of their cost, the cast-iron wedge is used in the majority of shops. It would be better to keep a few wrought wedges, as there are often jobs where the cast wedges are not safe.

More solid wedging can be done by the size shown than by thicker ones. In wedging iron and iron there is a tendency to slip, and the more tapering the wedge is, the more liable it is to slip. When securing a cope, or a number of chaplets, with iron wedges, they should generally be gone over two or three times; the tightening of one wedge will often loosen others, making it necessary to go over them all once or twice after the first wedging, each time rapping lighter.

The cut shown of a chaplet stem represents



one got up by an acquaintance who is employed in a bolt works. He has devised a machine for putting on the heads, and also claims originating the stem shown. Be that as it may, the plan is a good one.

For slanting cores, similar to those shown in the piston, chaplets with forged heads are not the best, on account of there being no chance for the head to adapt itself to the shape of the core. With a stem having a shoulder and riveting tit like the one shown, as large a plate head as desired can be readily riveted on, in such a manner as to be loose or tight. Castings are often lost on account of chaplet stems not having sufficient shoulders on to hold down the riveted head when the pressure comes upon them. The advantage of having such a shoulder as shown is apparent.

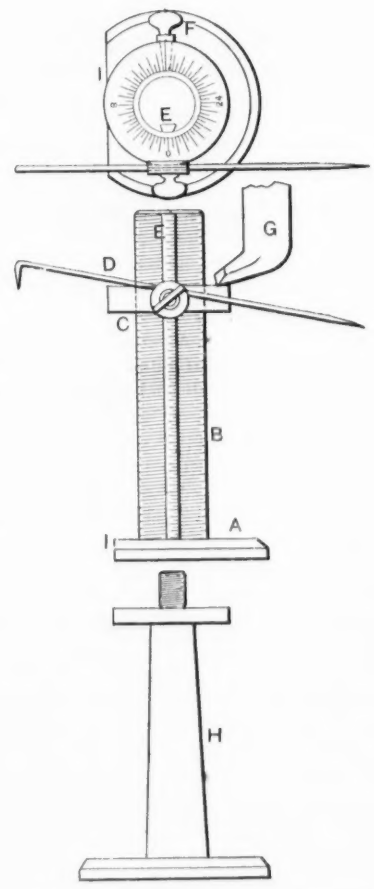
There are often cores used that require the chaplet heads to be bent, to correspond with their irregular surfaces or slanting faces. Such cores call for extra careful work in placing and holding the chaplets. In some cases it is best, if condition will allow, to file away a portion of the core, so that straight-headed chaplets can be used, or when making the cores provide for this. In some foundries round cores are often made flat where the chaplets are to rest, so as to give the chaplets a solid bearing.

The triangle shown illustrates a plan that can often he adopted in order to make the securing of chaplets more easy and reliable; by the use of this the chaplets are sure to have a good bearing, and also are not jarred by the use of wedges. To show the manner of thus securing a cope and its chaplets, suppose that we are going to get ready such a mould as shown.

After all the cores are set and clay balls placed where the chaplets are wanted, the cope is lowered down to receive the impression of the balls. The cope is now hoisted up, and the chaplet holes in the cope made, being sure that the holes are all reamed out at the face of the mould, as shown at *K*. Castings are often lost through neglect of this. *W* and *B* are illustrations of how such losses can happen. In *W*, the chaplet is all encased firmly in the sand. In *B*, the hole is made a little larger than the stem of the chaplet, but the one is nearly as dangerous as the other, as the chances are ten to one that the sand around the chaplets will be found dropped when the casting comes out. This may be caused either by having to push down the chaplet so as to rest on the core, or by the jarring of the chaplet when being wedged. When the chaplets are all placed in the cope as they should be, by having the hole easy for the stem to work up and down in, and also made larger at the face of the mould, so that there can be no danger of breaking down the face, the cope is then ready to be closed. For uneven or slanting core surfaces, as here shown, it is a good plan to place a little flour on the cores where the chaplets are to come, which is known by the clay marks; then when the cope is lowered down and all of the chaplets rapped down solid, the cope is again hoisted, when, by the impressions upon the flour, it can be known whether all of the chaplets have a solid bearing. If all are now found to be right, the cope is lowered down to stay.

In the piston mould shown there are eight cores, and to hold down each core there are three chaplets used. The top ones are made of ½″ iron and the bottom ones of ⅜″ iron. The heads on all the chaplets are 2″ square. The thickness of the metal in the casting is about one inch. There being eight cores, there are also eight triangle plates. These plates are now set, one upon every three chaplets. The black dots represent where they rest upon the chaplets.

After these triangles are all placed, there



A CONVENIENT SURFACE GAUGE.

are then two plate rings placed one over the other, the outer over the inner row of chaplets, as seen at *Y* and *F*, these rings being kept up high enough to admit of a wedge being placed between them and the triangle plates. Over the top of these two rings are now placed four railroad bars, they also being kept high enough to admit of wedging. Set at right angles to, and on top of these four bars are placed two heavy cast iron beams, as shown at *X*. The rings, rail bars and cast beams are all held up by blocking on the outer edges of the cope, as shown at *U*. The inner and outer rings are connected by three arms, which also extend from the outer ring to reach the outside of the cope. These rings being made purposely for this job were made in one casting. On top of the beams are placed all the weights needed to hold down the cope, if there is no chance to bolt it down. After the weights are all on, then carefully wedge the rails, rings and triangle plates. It was not intended that this article should cover all the ways that castings may be lost through improper wedging or setting of chaplets. The field for blunders is too broad to attempt any such task.

LETTERS FROM PRACTICAL MEN.

A Convenient Surface Gauge.

Editor American Machinist:

It seems somewhat strange to me that measuring tools for planers are so much neglected. I do not know of any gauge for setting planer tools to plane given thicknesses, that can be bought in the market. The gauge shown by G. Thompson in the AMERICAN MACHINIST of Jan. 29, 1881, is a good standard gauge and should be made by some reputable tool concern so that it might be placed in the hands of every mechanic. It is adapted to many other uses than setting planer tools, such as the setting of calipers to accurate sizes. All mechanics are aware of the difficulty of setting a pair of calipers to accurate sizes by means of an ordinary standard steel rule.

Such a gauge as the one referred to would obviate the trouble effectually. The adjustable standard gauge as made and used by me, is shown in the accompanying sketch. I do not intend to patent it, and therefore all are free to use it so far as I am concerned. The steel body of the gauge, *B*, is first to be turned up with a base, *A*, at the bottom. This base is cut off at one side, as shown at *I*. A dovetailed slot should be planed to receive a scale *E*, graduated to divisions of $\frac{1}{32}$ inch each. The scale should be deep enough to clear the bottom of the threads when cut, which number 32 to the inch. These threads should be cut to correspond with the graduations upon the scale.

A steel nut or collar, *C*, should then be cut to make a very tight fit upon the body, *B*, so that it will hardly go on by ordinary means. This collar should be drilled and tapped with a tapered tap, and a thumb screw, *F*, fitted to the hole as shown, after which the collar is sawed through at the center of this hole. By tightening this screw, *F*, the collar is sprung open and enlarged so that it will run freely up and down the body *B*, of the gauge. Before graduating the collar it should be accurately set to 2″ upon the body, and faced off to a standard gauge, or in other words, so that the distance from the upper surface of the collar to the bottom face of the base, *A*, will measure precisely 2″. It will then be right for each of the other positions upon the scale. The upper face of the collar should then be graduated into 32 equal parts, so that one complete revolution of this collar will cause it to move a distance of $\frac{1}{32}$ inch upon the body *B*. This collar should be hardened when possible, then ground upon a lathe.

In hardening, dip the slot downward. This gauge is made to caliper 2″ in and out and may be used to measure between the platten of the planer and the point of the tool *G*, or a finger, or scriber point, *D*, may be used as upon the usual surface gauge. By having extensions like *H*, to be screwed into the base *A*, this gauge may be extended indefinitely.

This tool is very convenient when used as a small surface gauge, as a person can hold the collar with one hand and turn the screw or body, with the other. It costs but little to make this tool. JAMES H. STEEN,

Canton, Ohio.

Old-Time and Modern Machinists.

Editor American Machinist:

There seems to be a wide difference of opinion concerning the skill of the old-time and modern machinist. An extract from an article in the AMERICAN MACHINIST, states that the modern machinist is not a machinist but an automaton or machine tender. An extract from an English publication states that the old-school millwright has become completely superseded on account of the division of labor and the manufacturer of specialties. The old-style millwright was supposed to be able to draw, work at the forge, the carpenter or pattern maker's bench, the lathe, or the vise—in short, to be able to do anything with few tools when working in remote places. The item stated that "they are now only to be found in remote country towns away from railroads, doing repairs for agricultural machinery." I suppose a thoroughbred blacksmith, pattern maker or machinist trained to his own trade must exceed them in skill. There was some very good chippers among the millwrights, and I am not clear that they would not make better figures on the floor of a machine shop now, than some of the machine tenders of the present time. Hand work requires longer time to learn than machine tending, and boys that get good practice and plenty of it, on the right side of 21, acquire a dexterity that they never lose. Of course there are exceptions. Some men never learn to file flat; it is not in them to learn. Many foremen seem to form different opinions of the same men. If one is a particular man that wants nothing but first-class work, a first-rate workman that has been accustomed to do good work in first-class shops will be appreciated. On the other hand, if another has had a superficial smattering of everything and is an advocate of the "lots-of-work-and-don't-be-so-particular" style, he is just as likely to favor some old-school rural millwright who has has spent part of his youth in a saw-pit. One of your correspondents states that in his shop any of his apprentices can make either a running or a driving fit with a water cut, and complains that the old-school men make fits by excessive filing. Perhaps he is not far from right, at any rate his system is the right way. It is a good sign of a turner when he makes little use of a file. Nothing leaves better work than tools. When a man cannot make a water finish on a wrought iron journal without the aid of a file and emery, it is time he was doing something else. Still, some foremen think otherwise, and not only advocate turning wrought iron dry, and filing, but advocate prick punch centering. To make a genuine first-rate fitter or vise hand, it is necessary that he should begin young, while his muscles are soft, and work gradually into it. To say that a youth can learn planing, turning, fitting and erecting, and command the highest wages going in three years, is preposterous. I hope to hear something more on old and modern machinists from some of your correspondents.

FORT WAYNE, Ind. J. K. C.

Shop Time-Keeping.

In the AMERICAN MACHINIST of Jan. 20, we published a request from a correspondent for information in reference to time-keeping. The following has been courteously furnished us, and although we are not sure that it quite meets the question of our correspondent, it is of interest as relating to the general subject of shop time-keeping.

Editor American Machinist:

Our system of time-keeping, although simple in its workings, is not very easy of explanation by letter. We have a blackboard with numbers painted on it from 1 to 1400. Every man is furnished with a brass check with a number stamped on it, and when our whistle sounds for the men to come in, they pass through a gate; each man showing his number and calling it out to the time-keeper, who stands at a window with the blackboard before him, and who crosses with a chalk mark on the blackboard the number called. When the men are all in, the crossed numbers show the men who have reported, and the time-keeper transfers them to his time-book. This is done morning and noon. Men holding checks, the corresponding number of which are *not* crossed on the blackboard, get no time. Our pay roll book gives the *name and number* of every man, and at the close of the week the time-keeper foots up the time made by each man, as shown by his book, and transfers it to the pay roll with the rate per hour.

I will add that an expert time-keeper can easily check 60 numbers per minute, with accuracy.

We have but *one entrance where checks are used*, the time of some of our men being taken in the shops immediately after the gates are closed, but I see no difficulty in having several entrances,—say men holding checks from 1 to 400 at one place, from 400 to 800 at another, &c.

We will be glad to explain our system more fully to any one wishing to adopt it, who will come to Chester.

WM. PARKER, Treas.

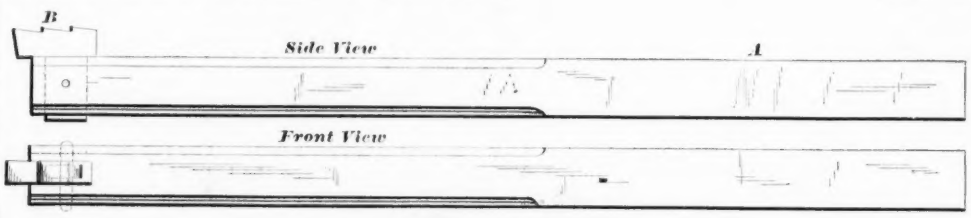
The Delaware River Iron Ship Building and Engine Works.

Improved Splining Tool.

Editor American Machinist:

A sketch of an improved spliner tool accompanies this description, and as I have never seen anything of the kind before, it might, perhaps, be of service to a great many interested in keyseating.

A, is simply a piece of steel $1\frac{1}{4}''$x$1\frac{1}{4}''$ square, the square part of which is planed, while in the other part the corners are simply rounded off.



SPLINING TOOL.

Within half an inch of one end is a slot $\frac{1}{2}''$x$1\frac{1}{4}''$. A bit is to be made of cast steel of any desired width at the cutting edge, and $1\frac{1}{2}''$ long. It is to be planed to fit the slot in the bar, and held in its place by a small screw with a countersunk head. This screw passes through the cutting bit, and is tapped into the bar upon the opposite side from which it enters. Further description is unnecessary. B. F. CHAPPELL.

South Windham, Conn.

Pulley Balancing Device.

Editor American Machinist:

The accompanying sketch is submitted for the especial consideration of Dynamicus, and for the fraternity. This device consists of the vertical shaft, *A*, attached to a shorter section, *L*, by means of a knife-edged universal joint, *I*, which will be better understood by the sectional view, *J*.

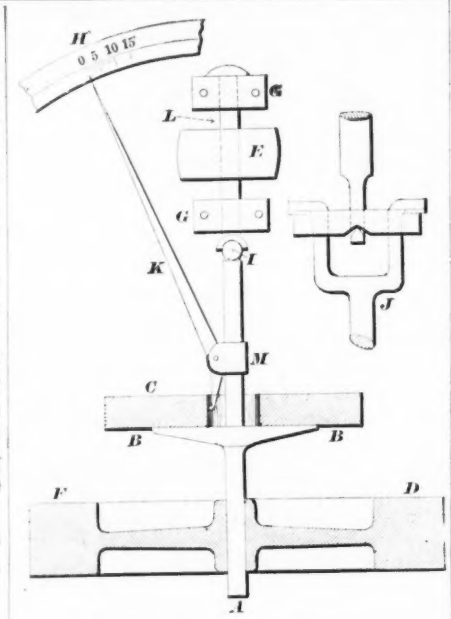
The short shaft, *L*, is supported by the boxes, *G G*, and motion is transmitted by means of a belt upon the pulley *E*. Upon the shaft, *A*, is a collar or plate faced off upon the upper side to provide a surface, *B B*, at right angles.

The disc, *C*, after being bored and turned, is placed upon the surface, *B B*. The hole in the center is sufficiently large to allow a free movement of the disc in all directions. The wheel, *D F*, to be balanced, is placed upon the lower end of the shaft *A*, as shown. To operate this device we will suppose the parts named to be in position, as shown, and the shaft set in motion, then if the wheel to be balanced is heaviest at *F*, the disc, *C* will move in the opposite direction. When it has moved to its new position the shaft should be stopped and the indicator arm, *K*, applied.

This indicator consists of an arm pivoted to the collar, *M*, which brings the short arm of the lever in contact with the internal surface of the disc *C*. Then by revolving the shaft, *A*, the defect will be indicated upon the graduated arc *H*.

To balance the disc, *C*, three of them should be worked together. HERCO.

Madison, Wis.



PULLEY BALANCING DEVICE.

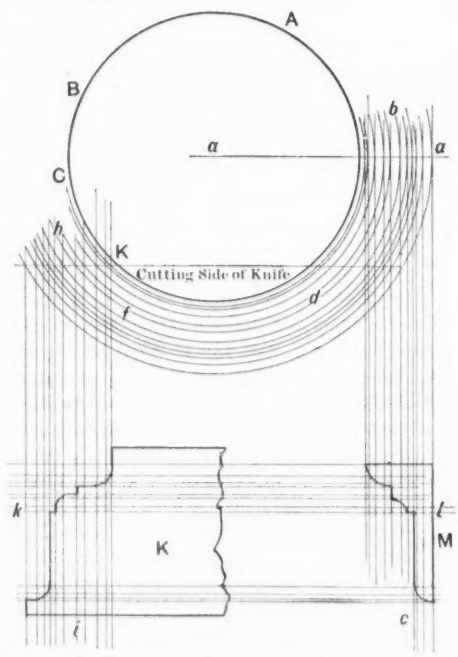
Method of Laying out Moulding Knives.

Editor American Machinist:

The following is given in answer to the inquiry of D. E. S., published in the AMERICAN MACHINIST of January 12, 1883. By the aid of the accompanying diagram, I will explain my method of laying out moulding knives.

Let *A, B, C*, be a moulding head, and *K*, the knife in position, being secured to the head. *M* is the moulding pattern, and *a, a'* the radial line parallel to the knife, *K*. Through the moulding, *M*, draw lines, *b, c*, intersecting *a, a'*. From *a* as a center, with radii corresponding to the lines *b, c*, draw the arcs, *b, d, f*, intersecting the cutting side of knife. Through these intersections draw the lines, *h, i*, through the intersections of lines, *b, c*. Through *M* draw the lines *l, k*; then, through the intersection of the lines, *l, k*, and *h, i*, will be found the form of knife as required. S. B.

Rochester, N. Y.



LAYING OUT MOULDING KNIVES.

A Worse Than Useless Table.

Editor American Machinist:

There is an old table of Colors and Temperatures, which has done duty in the Encyclopædias in connection with the article on tempering steel tools, since before the memory of man. Its meaning, if it means anything at all, is that steel tools after being heated and quenched in water or oil, and hardened, are to be tempered—or as I would say—have their temper drawn, by heating to the temperature indicated by the color of the oxidation. The following is the table:

Color of Steel.	Temperature, degrees.
Very faint yellow for lancets	420
Pale straw-yellow for razors, &c	440
Orange for penknives and chisels	470
Brown for scissors, &c	490
Red for carpenters' tools	510
Purple for watch-springs	530
Bright blue for lock-springs	550
Full blue for fine saws and needles	560
Dark blue for common saws	600
Greenish	630
Gray	750

It will be observed that this table calls for "orange color for penknives and *chisels*," "dark blue for *common saws*," and "red for *carpenters' tools*." Now what sort of a "kit" of carpenters' tools one would have after the chisels and saws were abstracted, I cannot understand; and it is not likely that the originator of this venerable fraud understood either, being, so to speak, but a table maker and not a regular carpenter.

I call this table a fraud, because some of its most important items are grossly wrong. The "purple for watch springs," "bright blue for lock springs," and "dark blue for common saws" being instances; the table maker perhaps saw blue saws and purple watch-springs, but if his observation had extended further he could have seen bright saws, and straw-colored watch-springs, and black lock-springs, the fact being that the temper of a saw is as near as may be that of a lock-spring, the polishing and blueing being done after the spring tempering.

It may be superfluous to add that a spring temper is obtained by heating the article after hardening in water or oil, to a very low red heat, about 1,000 degrees, just visible in the dark. Such a heat is determined, in ordinary work, by the flashing and burning of animal oil with which the article is smeared, or with a heavy spring rubbing with a tool handle, and observing the sparkle of the particles of wood. If required for a finish, the spring may be polished dry, without oil, as oil will prevent the oxidation, and re-heated upon a hot iron until the required color is obtained. This third heating produces no effect upon the temper of the spring, unless it reaches or exceeds the low red heat previously mentioned.

Braintree, Mass. WM. H. HARRISON.

Information Wanted on Casting Rolls.

Editor American Machinist:

A friend called my attention to a statement in A. A. Fesquet's translation of "A Treatise on Steel, &c.," by M. H. C. Landrin, Jr. (H. C. Baird, 1868), which appears to me entirely erroneous. We refer to you or your readers for fuller information.

Speaking of rolls for steel plate on page 292, paragraph 509, the author says: "The rolls are made of chilled cast iron, that is, of metal run into a mould of *wet sand*, which has the effect of producing a sudden cooling, or rather a hardening of the metal, extending as far as 0.02 to 0.03 of a meter from its surface, which is, therefore, white and very hard."

Knowing that chilled rolls are always cast in an iron chill, and being familiar with the effect of damp sand on molten iron, it appears quite impossible to make rolls in that way. If such a thing has ever been accomplished, as this good authority writes, I would like to know when and how.

Collinsville, Conn. TAPIS.

Fire Protection of Shops.

Editor American Machinist:

I have no doubt that most, if not all, of your readers will endorse what Mr. Lyne has written (Jan. 20) in regard to prevention of fire, but he has not mentioned what is I think a very essential part of all arrange-

ments for fire extinction, and that is the drilling of the firemen.

Some years ago, I had to remodel a mill. I had a good pump, No. 10 Cameron, and plenty of water. On the discharge from the pump, and in a convenient place, I introduced a straight-way valve, operated by a lever. Close to this valve, and between it and the pump, I made connections for three lines of 3" hose, each line having a separate valve. At this station was kept 600 feet of hose on 36" reel, and on a suitable rack hose pipes, hose wrenches, extra gaskets, and a copy of the fire signals. Wires leading from all parts of the mill, connected with a 14" gong also placed at this station, and copies of the signal code were placed at each wire terminus. At other two points in the building were reeled 250 feet of hose, with spare hose pipes, wrenches, &c.

Although the building was large, the force employed was only eight men and engineer and fireman per shift. As the mill was run night and day, I organized each shift into a fire company and drilled once a week, until each man knew his proper work. Afterward, an occasional drill or a false alarm kept all in practice.

I kept this game up for over a year, without once having any real need to use the tools, but eventually there came a day; the boiler house caught fire in the roof, and I can honestly say that it was worth all the trouble I had taken in the past, to see the cool, practical way in which those men went to work. No shouting; no noise; but in less than two minutes we had two ¾" streams on the fire, and in five minutes it was extinguished.

There are few mills or shops, where a good fire company could not be organized, and one will always pay in the end.

Pumps and hose are always good and necessary, but to be of use they must be handled promptly and skillfully, and to that end, I say, carefully drill the men.

Leadville, Col. A. WALLACE.

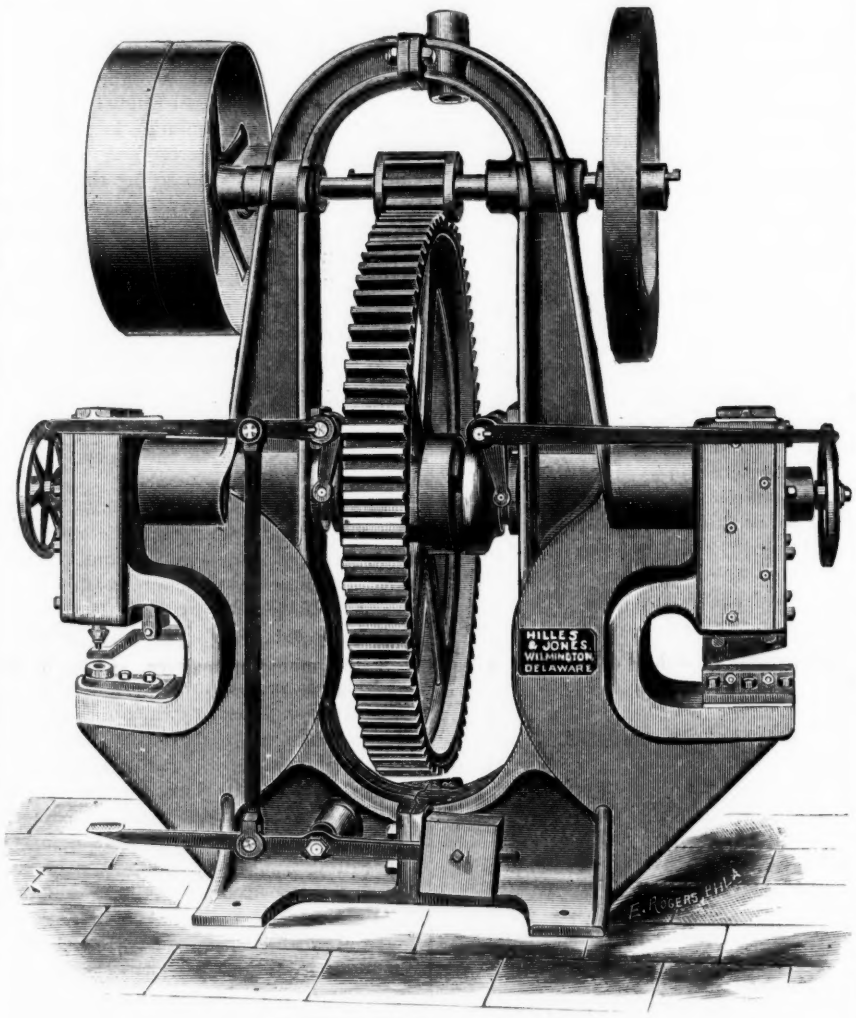
The Blow-Off.

One of the most important parts of a steam boiler is the blow-off. It is also one that is subject to more abuse in its construction, location, and use than almost any other fixture pertaining to the boiler. The most peculiar ideas seem to prevail in regard to its construction and position on the boiler. Some put it at the front end, some at the back end, and some put it in the middle of the shell. The great majority also, instead of putting it on the bottom of the shell, where it belongs, insert it through the heads of the boiler, anywhere from two to six inches above the bottom of the shell, thus rendering it impossible to entirely empty the boiler when desired, and greatly impairing its efficiency for any purpose.

The only place for a blow-off pipe to enter a horizontal externally-fired boiler is through the bottom of the shell within a foot or so of the back head. The boiler should be set slightly lower at the back end than at the front, say three-fourths of an inch for a boiler fifteen feet long. Then it may be entirely emptied by simply opening the blow-off valve, and all siphoning of water out through hand holes is obviated.

This, however, is not the most important reason for locating the blow-off at the back end of the boiler. In a horizontal externally-fired boiler the application of the heat, and the resulting circulation of the water, is such that the sediment is always deposited at the back end to a much greater extent than in any other part of the boiler. Obviously, then, this is the place for the blow-off. It is true that most boiler-makers now place it there, but there are many who still persist in placing it at the front end.

The proper method of constructing and attaching the blow-off pipe to the ordinary horizontal boiler is as follows: First, the pipe should be two inches in diameter. A circular piece of boiler plate about eight inches in diameter should be riveted on the bottom of the shell, with its center not over twelve inches from the back head. The hole for the pipe had better not be made until after this piece is riveted on, and then it should be drilled. If, however, facilities are not available for doing the job in this way, it may be drilled before it is put on. The hole should then be tapped, when it is ready for the pipe. The rivet holes on the inside of the shell should always be countersunk, and the heads of the rivets driven flush with the inner surface of the plate. If this is done, there are no projecting rivet heads to assist in the collection of sediment at this point. A blow-off attached in this manner, and provided with a straight-away valve outside the setting, will always give perfect satisfaction if properly cared for. In many cases, however, where the water is bad, they are not opened often enough, and the inevitable consequence is that they soon become filled up with scale and sediment. When this occurs, it may always be regarded as the best possible proof that it is located in just the right place.—*The Locomotive.*



COMBINED PUNCH AND SHEAR.

We have received some bulky and pretentious documents from David M. Richardson, Detroit, Mich., enclosed in an envelope bearing this legend in large type, "The Nation's Opportunity; Shall it be Improved?" A cursory perusal of the documents leads us to infer that the wonderful opportunity visible to Mr. Richardson is that of reducing the tariff as low as possible, with ultimate free trade in view, so as to obtain cheap labor and a chance of competing with foreign countries in securing a portion of the increased ocean carrying trade likely to be stimulated by low duties. A brief quotation from one of Mr. R.'s pamphlets will sufficiently indicate what he desires to see accomplished:

"It is claimed that protection secures high prices to labor, and that free trade will bring low prices to labor. We will accept these two propositions as correct. * * * Where all commodities and productions of every class and kind are produced with *low-priced* labor, when this *low-priced* labor goes into the market to purchase the necessaries and comforts or luxuries of life, it buys in a low-priced market."

This great advantage is enjoyed by the laborers of Italy and some other foreign countries, but we are very strongly of the opinion that American workmen are not too highly paid, and that they would not like to adopt rates of wages and rates of living expenses now enjoyed by the workmen of any free-trade country.

An ingenious type of locomotive engine has been invented by a Frenchman named M. Cottrau, says *The Enginеer and Iron Trades Advertiser.* It is designed for equally efficient use in both level surfaces and heavy grades. This engine possesses the qualities of locomotives constructed for level roads and those adapted for ascending heavy grades, since it is provided with wheels of large and small diameter that may be used at will. The two sets of wheels are arranged on the same driving axle. The large wheels are held apart the width of the ordinary track, while the small wheels are placed internally or externally. The engine rests on the large wheels on level surfaces, while the auxiliary wheels revolve to no purpose; but on reaching an ascent the engine meets with an elevated track, external or internal to the ordinary one, and which engages with the auxiliary wheels. The large wheels, in the latter case, then revolve to no purpose. The idea can, it is said, be carried out without disturbing the working of the locomotive. The same number of piston strokes can be preserved in the two modes of running so as to reduce the speed in ascending in proportion to the diameter of the wheels.

Combined Punch and Shear.

The accompanying engraving represents a punch and bar iron shear combined, made by Hilles & Jones, Wilmington, Del. These machines will punch holes up 1½" diameter, in 1¼" iron, and will cut bar iron from 3" by ¾" up to 6" by 1½", and round iron up to 2½" diameter. In this machine the punch and shear are independently clutched, so that either may be used separately or both together. The die seat of the punch is conveniently arranged, and the stripper is adjustable for varying thickness of metal. A hand-wheel is provided, by the use of which, when desirable, the punch or shear may be brought down to the mark, thus securing great accuracy. Shears will be furnished with these machines to cut any forms of iron.

These machines are designed for the use of locomotive builders, bolt makers, bridge builders, rolling mills, and for cutting puddle bars, &c. They are made in four sizes,

Manufacturing Notes.

Shaw & Lambert, Brockton, Mass., are building a new engine lathe, also needle machinery.

An Akron, O., man has offered a $5,000 building site free to the Hall Safe & Lock Company, of Cincinnati, to locate their new shops in Akron.

The Chase Turbine Company of Orange, Mass., has decided to build a large machine shop on the ground where the Kilburn chair shop was burned.

The new plant of the Marinette Iron Works Company, at Florence, Wis., which was erected at a cost of about $30,000, is now in running order. The machine shop is 90x45 feet, and 75 feet more will be added to it next season. The foundry is 49x50; it will also be enlarged. The blacksmith shop is 40x60, the steel warehouse 30x50, coal and coke house 30x50, pattern storehouse 30x70. These new works are filling orders for a 32x86 engine, an 18-inch engine, and a complete plant of hoisting machinery. The working force will be increased April 1st.

The Northwestern Iron Co. is the latest, and beyond question, the most complete iron working establishment in Duluth, Minn., if not in the Northwest, and includes machine shop, pattern shop, blacksmith shop, boiler shop, foundry, and steam and gas fitting shop. The different departments are in charge of competent and experienced men, and the business management is in the hands of W. M. Farr. The company have but just got ready for business, but the value of their product to December 31st was $26,000. They employ about 40 men, and expended in their present buildings, machinery, etc., over $40,000.—*Duluth Journal of Commerce.*

The Hartford Engineering Co., Hartford, Conn., have in process of construction, to fill orders, a large variety of sizes of their standard automatic engine, in addition to which they are building 50 special engines. They have in hand a heavy contract for sugar machinery, besides special work, in which may be noticed a compound tandem engine for a large pleasure steam yacht. They have recently, by request, tendered prices to one party for a number of automatic engines, some of them of large sizes. Altogether, their prospects for the future are in no way suggestive of business depression. Their shops are lighted by electricity.

The Philadelphia *Times*, says: It is estimated that at least 10,000 looms and probably 20,000 spindles are now idle in the cotton and woolen mills of Philadelphia and vicinity, in consequence of the continued depression in trade. It is impossible to give the exact figures, but this estimate is the lowest of several made by well-informed gentlemen. At the usual rate of running these machines, it means a total loss of work for from 5,000 to 6,000 operatives, while probably ten times as many are working on reduced wages or on shortened time. The depression is felt most severely in the business of producing the cheaper grades of cotton and woolen goods, and it is so general that, as one of the largest mill owners in the city said yesterday, "Everybody who can afford to close his mills is doing so." This gentleman said, in a decided tone: "We have stopped our mills because it would not pay to keep them running. I do not know how long they will remain idle, but it will be until the price of labor decreases or that of our products advances." This was said of a mill on which about one thousand operatives and probably twice as many people in their families depended for their daily bread. It could be duplicated in several sections of the city, and in every section there has been a material reduction either in wages or in the hours of labor, or both, within the past month.

The Southwark Foundry and Machine Company, 430 Washington Avenue, Philadelphia, have added to their existing line of manufactures, the department of hydraulic machinery, including steam pumps, mine pumps, and hydraulic elevators of all kinds. They have also added blowing engine and blast furnace work. Mr. J. L. Ferrell, formerly of the firm of Ferrell & Muckle, Philadelphia, has become associated with this company as general manager, the company having also purchased the patterns of the late firm. The manufacture of the Porter-Allen high speed engine continues to be the leading branch of the Southwark Company's business, with numerous and important orders ahead. About 55 Porter-Allen engines, varying from 300 H. P. down and intended for a great variety of purposes, are now in process of construction. Among these are three large blowing engines for the Everett Iron Company, Everett, Pa. The Lowell Milling Company, Lowellville, Ohio, have just ordered a 100 H. P. engine for flouring mill work, the order indirectly resulting from the reputation of similar engines running in that locality. The Bradstreet Lumber Company, Gardiner, Me., have ordered a 300 H. P. for lumbering uses. A 400 H. P. engine has just been started in the Tremont and Suffolk cotton mills at Lowell, Mass. The Springfield Iron Company, Springfield, Ill., have just ordered a 44"×48" rolling mill engine. A 100 H. P. has just been shipped to the Cambria Iron Company, being the seventh ordered by that establishment. A 44"×60" is nearly completed for the Lackawanna Coal and Iron Company, Scranton, Pa., who also have a 44"×48" in their works. The company have recently opened a New England agency in Boston, at 82 Water street in charge of Gilman W. Brown. Within two weeks inquiries of a very promising nature have been received for twenty-six Porter Allen engines of various sizes from 2,000 H. P. down, and specially gratifying prospects are reported for the business of 1883.

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NEW YORK, FEB. 10, 1883.

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An Industrial Evil.

Recent items of news about the wages of moulders in stove and hollowware foundries are by no means gratifying. In Cincinnati the stove manufacturers will ask a reduction of fifteen per cent. in moulders' wages; in Albany a like reduction has been decided upon, and in Pittsburgh notices have been posted in all the stove foundries ordering a reduction of five per cent. to take place on the 4th day of February. In other places reductions have been made. The demand for stoves is not as brisk as it has been, but the price of pig iron has fallen enough to give manufacturers some advantage in lowering the cost of production. With nothing but legitimate competition in the manufacture of stoves and hollow ware, it is probable that the wages of moulders in such establishments would not suffer a material reduction, if any at all. Stove moulders' wages (whether paid by the piece or by the day) usually range from $2 to $4, depending, of course, upon the mechanical ability of each individual. By way of comparison, let us refer to what is being done in two prisons of a single State of the thirty-eight composing our Union. The New York State Superintendent of Prisons recently submitted a report to the Legislature which shows that Perry & Co. regularly employ 900 men in Sing Sing prison in the manufacture of stoves and hollow ware, at 56 cents a day for each, and that another concern has 210 men regularly employed in Auburn prison in the manufacture of hollow ware at the contract price of 55 cents a day for each. When, in connection with this price, we consider the fact that all the work prisoners are capable of doing is exacted from them, also that the contractors have no shop rent or taxes to pay, it will be observed that competition of outside free labor is not at all to be feared. The contractors who thus employ 1,110 moulders at 55 and 56 cents a day are secure from all competition in the stove and hollow ware line. When trade gets a little dull they can cut prices so as to secure orders for all their production, and when it becomes very dull they can drive some manufacturers, who employ free labor, out of business and compel the cutting down of wages to the lowest possible ebb. It requires no argument to show that the contractors hold this power over honest industries that are unsupported by the State treasury. A glance at the prices of labor, as officially given, will convince any intelligent observer. In order to secure this advantage beyond the power of disturbance for a prolonged term the stove contract has been extended to Feb. 28, 1887, and the hollow ware contract to Dec. 31, 1884. The official who had the letting of prison contracts, as well as the few who are favored with their benefits, evidently anticipated legislative action looking to the excision of the public concern from our industrial system, in the near future, and therefore hastened to bind the State government to a continuance of special contracts as long ahead as they dare fix the time for expiration.

The stove manufacturers and their workmen are, however, by no means the only parties injured by prison contracts. Many other industries are disturbed both directly and indirectly by prison contract competition.

Where, for instance, in this country, can machinists be employed at 55 cents a day? Yet in Auburn prison, 265 men are regularly employed in making wagon axles at the contract price of 55 cents a day, and the labor of that number has been pledged to the contractor until Feb. 28, 1885. Every machinist working in an axle factory must compete directly with the labor of these Auburn convicts and when business is dull and wages low in stove foundries and axle factories the depressing influence must be felt in other foundries and shops.

But one State, California, has abolished the contract system in prisons, yet her convicts are regularly employed to the advantage of the State. Bills are now pending in the legislature of New York, Pennsylvania and other States to put an end to the prison contract system. If free artisans make their wishes known and felt in legislative bodies these bills will become laws, otherwise they will share the fate of other bills of the kind heretofore offered.

"In the Interests of English Manufactures."

Since the whole tariff has come up for overhauling and repairs, the interest in its ultimate revision has been almost as great in some European countries as it is at home. Every indication of the result in regard to iron, steel, hardware, machinery, woolen goods, etc., is caught up by the press of Great Britain and passed around with avidity. The *Ironmonger* of London, in a recent issue says, in reference to Congress and the tariff: "When it is borne in mind that the present members largely represent protectionist views, it can scarcely be expected that any revision will be in the interests of English manufactures." This is an admission as plain as if direct that those opposed to the protectionist views are regarded as favoring the interests of English manufactures, and we should certainly credit English manufacturers and their representative journals with knowing what those interests are. The *Ironmonger* continues by observing that in the next Congress "there may be a greater leaning towards lower duties." We have the impression that quite a number of the people of this country expect Congress to shape industrial legislation in the interests of American manufacturers and workmen, but it is possible that some of the members regard the matter in a different light.

Engineering in the Navy.

The annual report of the Chief of the Bureau of Steam Engineering, United States Navy, recently printed and sent out, presents facts that are not calculated to inspire in the average American citizen a feeling of patriotic pride over our ships-of-war. A list of forty-eight vessels is given, every one of which needs important repairs to engines and boilers, or entire new machinery. "Requires overhauling" is the expression applied to a large part of them. A long list of vessels repaired last year is also included in the report. The last page gives estimates of the amounts required for the bureau for the year ending June 30th, 1884. We observe that something over four million dollars is the sum required for repairs and preservation, and the construction of new machinery. We gather from the report, as a whole, that our navy is in a bad condition, notwithstanding all the money that has been squandered upon it. Chief Engineer Shock might properly have included the advice in his report that the engines and boilers in two-thirds of our vessels should be sent to the junk shop, and the proceeds applied towards putting the other third in serviceable condition. He expresses the opinion that too few assistant engineers are allowed for vessels at sea, and thus delineates the difficulties to be met since, by Act of Congress last August, the working force of the engineer corps is reduced one-half:

"The only resource must necessarily be the employment of mechanics or machinists, so called. Such a system, after a trial of eleven years in our Navy, had to be abandoned for the reason that competent respected mechanics could not be found, and with such as were obtained the record shows that the repairs required to machinery were numerous and extensive, often involving the expenditure of large sums of money. Every inducement was held out to secure and retain good men; their pay was increased from $55 a month to $61.50, then to 76.50, the latter but little less that the pay of the educated cadet engineer; but all to no purpose, for none, with a few rare exceptions, except the idle or the intemperate, would enlist, and in the case of the exceptions noted, many availed themselves of the first opportunity and obtained their discharge.

"It must also be borne in mind in considering the machinist system that the United States has no large merchant steam marine like Great Britain from which to draw a supply of machinists thoroughly trained in the duties of the engine room. It has been asserted that the engineer department of the British Navy is managed upon this principle. This is not strictly true; but granting it for the present, it must be remembered that the social system prevailing in Great Britain is vastly different from that in the United States. In the former country the laborer, the mechanic, the artist, and the merchant are educated from childhood in the belief that those in official positions in the army and navy and nobility, are of gentle blood, a higher race of beings than themselves, occupying a plane whose level they never can attain. Not so in the United States. Here every boy is taught that he is a possible 'President,' and the intelligent, educated American mechanic is not less ambitious than his fellow-men in other walks of life in his efforts to elevate himself and family in rank or standing among them."

The New York *Evening Post* cries out against any increase of duty to "protect the manufacture of boiler plate two and half inches thick!" We agree with the *Post*. An increase of the tariff on this important production would tend to discourage the construction of boilers with shells two and a half inches thick by unduly raising the price of the "raw material." As a result, we should have by far the greater portion of boilers made of plate something less than two and a half inches thick; for instance, two and a quarter or two and seven-sixteenths inches for large boilers intended for high pressure. In view of the weakness of many boilers in use, as evidenced by numerous disastrous explosions, the timely protest of this watchful guardian of public interests against laying any heavier burdens upon the shoulders of the manufacturers of *strong* boilers should be heeded. The *Post* may be relied upon to defend the rights of this industry.

The Western Union Telegraph Company has decided to put all its wires in New York city underground. A contract has been given out for the laying of a tube under Broadway from the company's building large enough to contain 200 wires. This contract, it is said, will cost the company a large sum, but they probably foresaw that the people would soon demand the sinking of the wires underground, and have anticipated any compulsory act of law.

We regret to hear of the recent death of Dr. Edward H. Knight, the author of Knight's American Mechanical Dictionary. His loss will be deeply felt in mechanical circles.

With steel rails at $40 a ton it would seem to be a favorable time to contract for laying new track. Probably not much lower prices could be expected.

Literary Notes.

Volume X of Ealy's "Blue Book" is out for 1883. The present is the third book of the series, comprising the machinery trades in addition to the hardware and metal trades, as formerly. The present volume contains 792 pages, and about 80,000 names. A somewhat extended examination and comparison show that great pains have been taken in its preparation. A convenience that will be appreciated is, that street and number are given in connection with the lists in the large cities. The publishers are the John W. Ealy Company, 51 Chambers street, New York, and 79 Dearborn street, Chicago.

The *Bulletin of the American Iron and Steel Association* for January 24th, publishes tables of the importations of iron and steel during the fiscal year ending June 30th, 1882. It proceeds to figure out the value of the labor required to produce the article, and concludes as follows:

"The total wages, therefore, of which American workingmen were deprived in the fiscal year 1882, by the importations of iron and steel, were $56,000,000. This would employ over 93,000 men for three hundred working days at an average rate of $2 per day. Furthermore, if the money paid for these importations had been kept in circulation in this country, the balance of trade would not have been turned against us, more money would

have been available for home enterprises, and our prosperous career would not have been so seriously checked as it has been."

The *Northwestern Lumberman*, of January 13th date, contains 212 printed pages, with a list of saw mills in the United States and Canada, and various other matters interesting to lumbermen. The number of mills in the United States is given at 15,020, and in Canada, 657. Pennsylvania has the largest number, 1,291; New York next, with 1,069; Indiana third, with 1,006; and Michigan fourth, with 933.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(57) G. K., Buffalo, N. Y., asks: How large should a model for the patent office be? *A.*—Models are not as a general rule required. When they are required, they should not exceed 12″ in any direction.

(58) A. F. W., Howard, R. I., asks: 1. Will you tell me the proper size of openings in a grate for hard coal, egg and nut size? *A.*—For egg from ½″ to ⅝″; for nut ¾″ to ⅞″ inch. 2. How many square feet of grate surface should I have for a boiler 60″ diameter, 16 feet long, with 84 tubes 2″ diameter? *A.*—30 feet will be a very good proportion.

(59) F. W., Duluth, Ia., asks: How can I determine the expansion in a boiler 6 feet diameter and 16 feet long, for an increase of temperature of 300°? *A.*—Wrought iron is said to expand .000007 of its dimensions for each degree of heat; hence for 300 degrees the expansion would be 300×.000007=.0021. For 16 feet (192″) the expansion would be 192×.0021=.4032 inches, and for 6 feet (72″) the expansion would be 72×.0021=.1512 inches.

(60) J. H. A., Yarmouth, Me., writes: I am putting up a small engine to drive a rotary furnace, using chain belts. I have two countershafts, and hence three belts. One of the belts is larger than the other, and the question is whether the large belt should be used on the engine or on the rotary? *A.*—You neglect to state whether the rotary runs faster or slower than the engine. If the speed of the belts is equal, then the largest belt should be from the engine. If there is much difference in belt speed, the largest belt should be used where the speed is slowest.

(61) J. A., Cedar Rapids, Ia., asks: What weight would be required on a fly-wheel 30″ diameter, running 250 revolutions per minute, to equal 5-horse power? *A.*—Consider the question as if for a hoisting engine lifting a weight. The circumference of the pulley is 7.854 feet, which multiplied by the revolutions is: 7.854×250=1963.5 feet per minute which the weight will be lifted. Five-horse power is equal to 33000×5=165000 foot pounds, hence the weight would be 165000÷1963.5=84.03 pounds. If you refer to the friction dynamometer, consider it as a pulley of a diameter equal to twice the distance from the center of the shaft to the point where the weights are suspended, and calculate as above.

(62) A. J., Allegheny, Pa., asks: 1. If a box, say 2 feet square, made of common floor boards were sunk to a depth of 30 feet in the ocean, would it withstand the pressure? *A.*—We think not. In any event it would fill with water. 2. What is the greatest depth to which the sea is agitated in a storm? *A.*—It is not known.

(63) F. F. R., Farmdale, Ohio, asks: Which would be the most economical; to run a 10″×16″ engine 150 or 250 revolutions per minute, either speed being sufficient to do the work. *A.*—It will depend on circumstances. If a plain slide valve engine, and the work can be done at 150 revolutions without carying steam of more than 80 lbs. pressure, it will be more economical to run it at that speed. If an automatic cut-off engine, it would be necessary to know the amount of work being done and the steam pressure carried. as well as other conditions, before deciding.

(64) F. K. T., San Francisco, Cal., sends sketch of a boiler 40″ diameter, with a 26″ flue of 5-16″ iron, 8 feet long, which he says is guaranteed safe at 120 lbs. pressure, and is frequently used at 130 and 140 lbs. He asks what we consider a safe working pressure? *A.*—There is not as much data on the strength of flues to resist collapsing pressure as is desirable. Our own opinion was that a safe working pressure was so much below that given by our correspondent that we submitted the question to an engineer of high authority in such matters, and his opinion, in which we concur is, that a safe working pressure for such a flue is 60 lbs. The thickness of the shell of the boiler is not given, but we assume the flue to be the weakest part.

(65) E. M. G., New York, asks: Please give me a rule for calculating the horse power of a steam engine? *A.*-See answer to question 72, March 4, 1882. 2. How can I calculate the horse power of a boiler? *A.*—There is no rule applicable. 3. How can I calculate the proper size of a feed pump, the dimensions of boiler being known? *A.*—Make the pump of sufficient capacity to supply a cubic foot of water for every 12 feet of heating surface of the boiler. 4. Will a steam pump work as well without as with a check valve? *A.*—It is advisable to use a check valve. 5. Is it necessary to increase the throw of an eccentric when lap is added to a valve, and if so, why? *A.*—If the throw is now sufficient to properly uncover the ports after lap has been added it may not be necessary to increase the throw, otherwise it will. 6. At what speed should an engine with two cylinders, each 6″×10″ run to develop 16 horse power net, with boiler pressure 60 lbs.? *A.*—About 250 revolutions per minute. 7. Is it practicable to connect an injector direct to a hydrant with water pressure of 40 lbs.? *A.*—Injectors are frequently connected and worked in this way, but unless the water pressure is nearly constant it is better to use a tank.

(66) A. H. G., St. Louis, Mo., writes: I and several other readers of your paper in this neighborhood, are troubled with the water raising in our boilers. We have tried everything conceivable without success, and have concluded to appeal to you. I enclose a sketch of construction of boiler and the manner in which the steam drum is connected. The water actually rises out of boiler

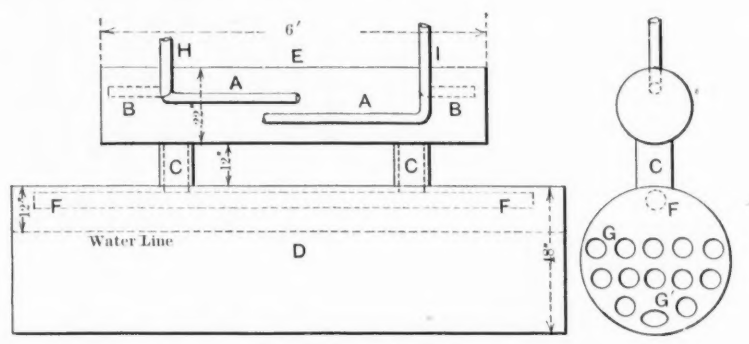

DIAGRAM OF BOILER.

into drum, and sometimes completely stops the engine. The pipes you see in steam drum become filled with water. I cannot see how water could get into these pipes if it did not rise up to their level. If you can suggest a remedy you will confer a great favor upon us. In the sketch, *D* represents the boiler with a steam drum, *E*, attached at the top by two connections, *C*, *C*. Steam is taken from the pipe, *I*, to drive elevator engines, while the pipe, *H*, leads to the heating house. Space at sides of boiler between the brickwork and shell is 6″. There are twelve flues 6″ in diameter and placed 3″ from the shell. The pipes, *A*, *A*, suddenly fill with water and bring the engines nearly to a stop. *A.*—The arrangement of the pipes, *A*, *A*, is decidedly bad, for the reason that the steam is all taken from one position in the drum. When you suddenly open the valves in the pipes, the water is sure to rise into the drum. Your pipes would work very much better if turned as shown by the dotted lines, *B*, *B*. If after turning them in this direction the water still troubles you, put in a pipe, as shown by the dotted lines at *F*, *F*. This pipe should have T connections at *C*, *C*, with caps at each end of the horizontal part. Holes should be drilled through the upper side the entire length, the combined area of which should be equal to that of the two upright openings, *C*, *C*. Drill three holes ⅛″ in diameter upon the bottom of the pipe, *F*, *F*, to allow the water of condensation to drain back into the boiler. The philosophy of this arrangement is that it takes steam from almost the entire length of the boiler instead of only one particular locality, as in your arrangement.

BUSINESS SPECIALS.

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

Portable Forges, $10. Holt M'f'g Co., Cleveland, O.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N.J

C. M. Morse, Mech. Engineer, 95 Liberty St., N.Y.

F. Samuelson, Pattern Maker, 38 Gold St., N. Y.

James W. See, Consulting Engineer, Hamilton, O.

Acton's Improved Bogardus Mills, warranted. Room 14, R. R. Depot, Franklin & Centre Sts., N. Y.

Mechanical Engineer. Complete motive power outfits a specialty. Peter Banta, Cold Spring, N. Y.

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

J. C. Hoadley, Engineer and Expert, 28 State St., Room 28, Boston, Mass.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York

Foot Power Machinery, for workshop use, sent on trial if desired. W.F. & John Barnes, Rockford, Ill.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

Lyman's Gear Chart; how to lay out gear teeth. Price, 50 cts. E. Lyman, C. E., New Haven, Conn.

Universal grinders for lathe-centers, chucks, angles or cylinders. C.C. Hill, room 8, Uhlich Block, Chicago

Machine designing and general engineering work, T. J. Winans, 54 M. & E. R. R. Av., Newark, N. J.

A handsome monthly journal sent free to engineers and mechanics the year round. Send postal for it to Money Saver, 95 Liberty street, New York.

Steel Forgings, either plain or crank, up to 10,000 lbs. in weight. Address, Pennsylvania Steel Co., 160 Broadway, New York.

Light and fine interchangeable machinery to order. Foot and power lathes, slide rests, &c. Catalogue for stamp. Edwd.O.Chase, Newark, N.J.

One hand bookbinder's embossing press for sale. Size of platen, 16″ x 24″. In first-class order. Ohl & Co., E. Newark, N. J.

New Year's Present—"The Complete Practical Machinist," by Joshua Rose, 440 pp. 196 illustrations. $2.50 postpaid. Address, P. O. Box, 3,306 N. Y. City.

Boring Bars made all sizes for all purposes to bore both straight and taper work. Pedrick & Ayer, proprietors, L. B. Flanders' Machine Works, 1025 Hamilton street, Philadelphia, Pa.

"How to Keep Boilers Clean," and other useful information for steam users and engineers. Book sent free by the publisher, Jas. F. Hotchkiss, 84 John street, New York. Mention this paper.

Free—"Useful Hints on Steam." A book of 96 pages, illustrated. Valuable to engineers, steam users and those about purchasing steam machinery. By mail, 15 cents, or free on personal application. E. E. Roberts, 107 Liberty St., New York City.

The Theoretical and Practical Boiler Maker, 335 pages, and 37 lithograph plates. Published by the author, S. Nicholls, Yorkshire street, Blackpool, England. Mailed on receipt of P.O.O. value $1.83, to Blackpool. See Review, AMERICAN MACHINIST, p. 8, July 22, 1882.

The *Sanitary Engineer* of January 25, contains an illustrated description of the work of the New York Steam Heating Company, the largest enterprise of its kind in the world. Sold by news dealers; 7 cts., weekly.

COVERINGS FOR STEAM PIPES, &c., &c.—We took occasion a few weeks since to call the attention of our readers to the advanced position occupied by the H. W. Johns Manufacturing Company of this city in the matter of non-conducting covering for steam-pipes, boilers, &c., &c. That we were fully justified in doing this is manifested in the fact that the above company have very recently completed large contracts for the following named parties: Church & Co., Greenpoint; D., L. & W. R. R. Co. at Hoboken and Kingsland; Morris & Cummings Dredging Co.; Pennsylvania Railroad Co.'s new ferry boats, Baltimore and Chicago; Hotel Brandon, Park avenue; United States new Barge Office; J. Ellis & Co., Edgewater, N. J.; Orange Water-Works, Orange, N. J.; Eagle Pencil Co., city, and many others.

MANUFACTURES.

A company has been formed at Jackson, Mich., to manufacture the Desmond boiler injector, patented by John Desmond, of that city, who will be superintendent of the works.

W. J. Adam, of Joliet, Ill., has lately added to to his barb wire manufactory a machine shop, which is kept busy, and which he proposes to enlarge next season.

A. M. Powell & Co., Worcester, Mass., are getting out a new 16″ lathe and a 26″ square planer. Quite a number of inquiries have been received for their new 24″ chucking lathe.

The Beloit, Wis., Malleable Iron Company have their buildings completed, and have begun to turn out castings. They will employ seventy-five men when in full blast.

The Diamond Anti-Friction Metal Co., St. Louis have put in a new engine and boiler to run their machinery and will shortly add a few pieces of new machinery to their works, such as lathes, drills, etc.

One of the largest carpet factories in the country is soon to be erected upon the vacant tract of land west of the railway track at Pullman, near Chicago, Ill., and another new village is expected to follow.

The Chattanooga (Tenn.) stove foundry is expected to be completed by June 1. One hundred men will be employed. It will be the first foundry of the kind built south of the Ohio river—so says *The Tradesman*.

The Locomotive Works of T. H. Paul & Sons are to be removed from Cumberland to Baltimore, Md., and one of the buildings, 60x150 feet, which is to be the erecting shop for locomotives, has been built. The machine shop proper and the foundry, which are to be about the same size, if not larger than the erecting shop, are now under construction. The firm expect to employ 400 to 500 men.

David W. Pond, Worcester, Mass., is pushing things, in building machine tools, twelve hours a day with a force of 210 men, yet his castings are made in outside foundries. Orders are coming in freely.

The Philadelphia Creamery Company, of which Mr. Evans, of Cooper, Jones & Cadbury, is one of the parties in interest, are looking for manufacturing quarters in Philadelphia, where they expect to manufacture butter-making machines.

Notwithstanding the extensive additions made to their works last summer, the growth of their hand and power crane business is such, that the Yale Lock Mfg. Co. of Stamford, Conn., expect to put up an additional shop 300 feet long early in the spring, expressly for that branch of their business.

Work has begun on the new wire drawing mill and barb wire works of the Lambert & Bishop Wire Fence Company at Joliet, Ill. The building will be of brick, 120x276 feet, two stories, and when completed, will cost with machinery about $150,000.

The Michigan Malleable Iron Company, Detroit, Mich., manufacturers of malleable and gray iron castings, are to add another air furnace to their plant, which will increase their output fifty per cent. They make only air-furnace iron.

J. A. Gilkerson is building a new machine shop 30x84 feet at Homer, N. Y., for the manufacture of small machinists' tools. He expects to be fitted up and ready to start by April 1. A new bolt cutter and a new screw slotting machine will be among the specialties.

A citizen of Dighton, Mass., proposes to give the Old Colony Railroad Company ten acres of valuable land near the depot, as a site for the repair shops which the company proposes moving from Boston, and the majority of the citizens favor exempting the company from taxation for a number of years, should it decide to locate the shops there.

Starr's Iron Works at Camden, N. J., owing, it is said, to business complications arising from dullness of trade, etc., are to be sold soon at master's sale. The works have a capacity for employing a force of over 1,000 men, and about 300 are now working there. It is reported that the Pennsylvania Railroad contemplates buying the works and using them as shops and for foundry purposes in connection with the road.

R. A. Belden & Co., (Machinists' Tools and Drop Forgings) Danbury, Conn., write us: We have quite doubled our facilities for getting out drop forgings and our improved circuit planers, which we have been very much driven on. Have run full time, ten and twelve hours per day the last year. We have booked nearly as many orders at this time as we had last year. The present outlook is good for steady business for at least three months ahead, as we have orders to last for that time now on our books. We cannot say what business will be after that time.

John Acton, who has had some years' experience in building the well known "Bogardus" mill, has taken out patents representing material improvements in their construction and has commenced their manufacture at room 14, Harlem R. R. depot, Franklin street, New York. These mills as constructed by Mr. Acton are calculated for grinding to any degree of fineness such substances as cannot be ground in ordinary mills, including bones and other animal matter, minerals, &c.

The Pratt & Whitney Company, Hartford, Conn., inform us that their business for the year 1882 was $100,000 in excess of that of 1881, but that while as yet there is not much prospect of a diminution, yet they do not anticipate their business for 1883 will equal the somewhat abnormal volume of last year. They are building tools for export, amongst which we noticed a 48″ lathe and a 14″ shaper on orders from Prussia. They are bringing out several new tools, particularly three new lathes, one with a 32″ foot bed.

Wm. Allen & Sons, Worcester, Mass., did twice as much business in boilers, feed water heaters and bleaching keirs, during 1882, as in any previous year. They placed within twelve months no less than 14 boilers, averaging 80 H. P. each in the city of Worcester, besides feed water heaters and purifiers. Among their present city orders are three for feed water heaters, one for two 100 H. P. boilers for the Pakachoag mill, and one for two boilers to go into M. J. Wittall's carpet factory now building. They have recently sent a 60 inch by 16 foot boiler to Furbish & Son, Philadelphia, two boilers to Salem, N. C., two boilers to Piqua, O., and two boilers and a feed water heater to Baton Rouge, La.

The U. S. Metallic Packing Co., has been organized to succeed the company of the same name formerly located in Boston, working capital having been increased from $50,000 to $250,000. James P. Scott, son of the late Col. Thos. A. Scott, president of the Pennsylvania Railroad, is one of the parties in interest, as are also the Westinghouse corporations of Pittsburgh. E. P. Monroe, who was general manager of the old company, occupies the same position in the new. The company has erected a brick shop 48x60, at corner 13th and Carpenter streets, Philadelphia, for the manufacture of packing for marine and stationary engines; the locomotive packing being manufactured at the shops of the Westinghouse Air Brake Co., at Pittsburgh. The general office of the company is at 267 South Fourth street, Philadelphia. The locomotive packing, made by this company, has been adopted by the Pennsylvania Railroad and all its branches and leased lines.

Dubuque, Iowa, anticipates soon having a new malleable iron works.

The *Industrial World* says: A new boiler factory employing 50 to 75 men will be established at Battle Creek, Mich.

F.E.Reed, Worcester, Mass., has 30 men employed in his shop full time. Orders continue good for his new pattern engine lathe.

The Westinghouse Air Brake Co., Pittsburgh, Pa., have purchased additional ground adjoining their works in Allegheny City, and will build an addition to their foundry.

McLinn & Co. Milesburg, Pa., have just completed a wire mill of 12 tons daily capacity. They make pig iron from their own ores and carry it through all the processes necessary to convert it into wire.

The St. Louis office of the Jarvis Furnace Co., have received orders to set three boilers at the Cronin Mills, Bellville, Ill. Slack coal will be used for fuel, which can be obtained at a cost of 2 cents per bushel. and it is expected they will manufacture a barrel of flour for one cent, for fuel, which is thought to be the best result ever obtained.

Smith & Sayre Manufacturing Co., 245 Broadway, New York, write us: Our business was interrupted somewhat during the early part of the year just closed by the fire which occurred at our works in October, 1881. Business during 1882, was very satisfactory, and so far as we can judge now, prospects for 1883, are very favorable.

The new shops of the Holyoke Machine Co., Worcester, Mass., have the heavy machinery in place on the lower floor and are turning out Hercules water wheels of various sizes. The demand for this wheel is ahead of the capacity of the shop to supply it, but as soon as the shop is in full running order the demand will be promptly met.

Prentice Brothers, Worcester Mass., keep 50 men steadily at work making upright drills and lathes. Upon a recent visit to their shop we noticed two well made and neatly finished drilling machines ready to ship, each 39 inches swing and weighing two tons. One of them is to go into a new machine shop somewhere in the Celestial Empire.

The Atlas Engine Works, of Indianapolis, Ind., report their business in a flourishing condition, and consequently on the increase. They have received within the past few weeks a large number of orders for engine and boiler outfits, ranging in size from 20 to 600-horse power, and to be shipped to 23 different States, besides several for foreign shipment. Among other orders are two for Corliss engines having a steam cylinder 32″ diameter and 48″ stroke; one for the Winona Lumber Co., at Winona, Minn., and the other for D. L. Wing & Co., of Litchfield, Ill.

Boynton & Plummer, Worcester, Mass., will move, March 1st, into a new shop erected near the Junction expressly for their business. It will give them fully one-third greater capacity for manufacturing upright bench and power drills, six and eight inch shapers (for hand or power), and various sizes of bolt cutters to cut together from one-quarter to one and a half inch bolts. Their new eight-inch shaper, illustrated in a recent issue of the AMERICAN MACHINIST, is attracting favorable notice among machinists. There are other machines which they have intended to bring out, but heretofore have not had room to do so.

C. M. & E. E. Miller, and several parties in the East, have commenced operations for starting brass works in Canton, Ohio, for the manufacture of steam fitting and plumbers' goods. A stock company will be formed immediately, and a portion of the building of the Miller Company, which are to be used, will be ready for occupancy in the Spring. The company will employ at the start from thirty-five to fifty men, but the force will soon be largely increased. It is the intention of the Miller Company to eventually build new shops, and resign the present ones to the brass work.

Machinists' and Engineers' Supplies.

NEW YORK, Jan. 25, 1883.

Trade in supplies this week is fair and prices are steady. Business as a rule has not started off with the rapidity that some expected, with the opening of the new year; however, the indications of a prosperous year are very encouraging. Buyers and consumers now confine their demands to immediate wants, thus preventing the accumulation of a large stock upon their hands. Rumors in regard to contemplated changes in the tariff continue to maintain a spirit of apprehension in reference to the future.

Manning, Maxwell & Moore, 111 Liberty street, New York, have just issued a large book containing advance sheets of their general catalogue soon to be issued. The one here referred to contains illustrated descriptions of iron-working machine tools, embracing a great and very complete variety. This book is composed of pages 151 to 330 inclusive, making in all 177 pages, well printed and indexed.

Iron and Metal Review.

No changes worthy of notice have taken place in the Pig Iron market since our last report, and consumers still maintain their conservative disposition. Sales are generally of small lots, so that the stock accumulated at the furnaces is slowly disposed of.

The low prices of Scotch Pig somewhat affects sales of domestic brands. We quote prices as follows: Foundry No. 1, $25. Foundry No. 2 X, $23 to $23.50. Grey Forge, $19 to $20.

Prices of Foreign Iron being lower than domestic brands, there is necessarily more business being transacted in this line than formerly. Special concessions have induced buyers to purchase quite liberally.

We quote Coltness at $25.50 to $26; Glengarnock, $22.50 to $23; Gartsherrie, $25 to $25.50; Summerlee, $24.50 to $25; Carnbroe, $22; Eglinton, $21.50 to $22; Langloan, $25.50.

Wrought Iron Scrap has been in light demand during the past week. Prime selected from yard is quoted at $27, and ex ship at $26 to $26.50.

Iron Rails are still quoted at $40 at the mill.

Old Rails are dull at $25 to $25.50 for Tees, and $27 for Double Heads.

Merchant Bar has improved during the past week, there being a fair demand at the present time. Prices range from 2.30c to 2.40c. Structural Iron is dull.

Copper continues in slow demand at 18c. Banca Tin, 22¼c. to 22½c. Straits and Malacca, 21¼c. to 21¾c. Billiton and Australian, 21¾c. English Lamb and Flag, 22¼c. Spelter, Common Domestic, 4.65c to 4¾c. Refined, 8c. to 8¾c. Lead, 4¾c. Refined, 4.74c. to 4.80 c. Antimony, Hallett's brand, 10⅛c. to 10¼c. Cookson's, 11c. to 11¼c.

WANTED

"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

Experienced draughtsman on machine work, wants engagement. Address, BOX 10, AM. MACH'T.

Wanted—A strictly first-class foundry foreman. A desirable and permanent position to the right man. Address, H. E., this office.

Situation wanted by a first-class engineer, to take charge of high or low-pressure engines. Address, Practical Engineer, office AMERICAN MACHINIST.

Wanted—A good man to act as foreman in a brass shop, manufacturing specialties. Address, James Jenks, Detroit, Mich.

Wanted—A man thoroughly competent to take charge of our cost and time accounts. Must have had experience in large shops. Address, with reference, the Hartford Engineering Co., Hartford, Ct.

Wanted—Situation as foundry foreman. Thirty years' experience, fifteen as foreman. Accustomed to all kinds of work, both light and heavy, core making and melting. Address, B., Lock Box 176, Holyoke, Mass.

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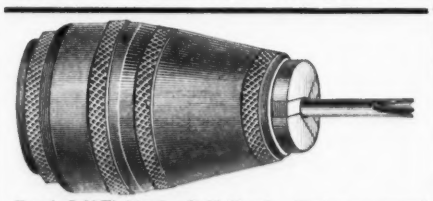

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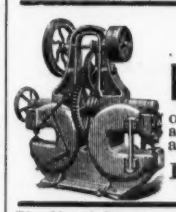

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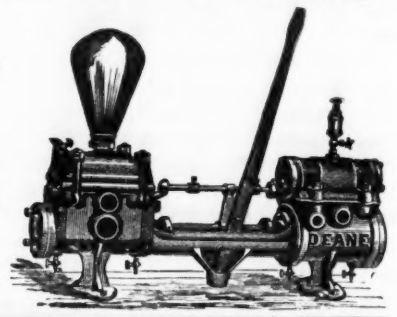

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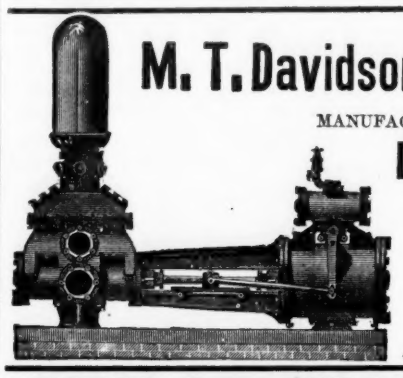

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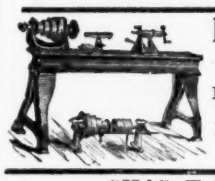

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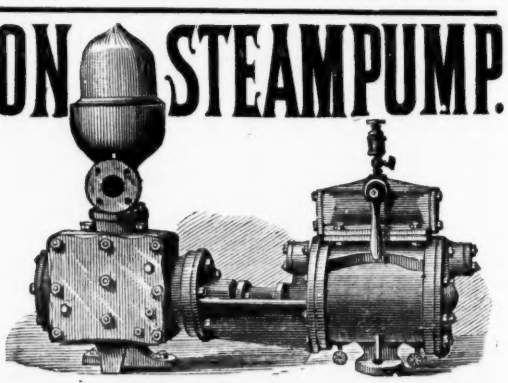

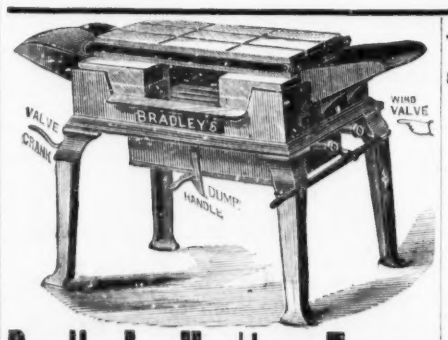

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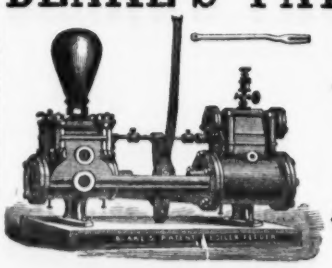

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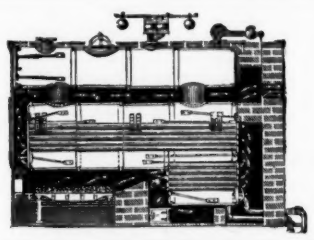

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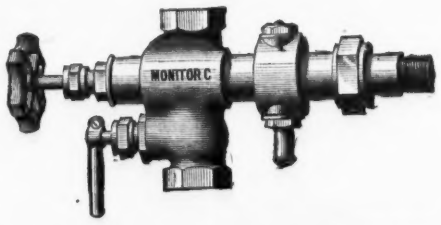

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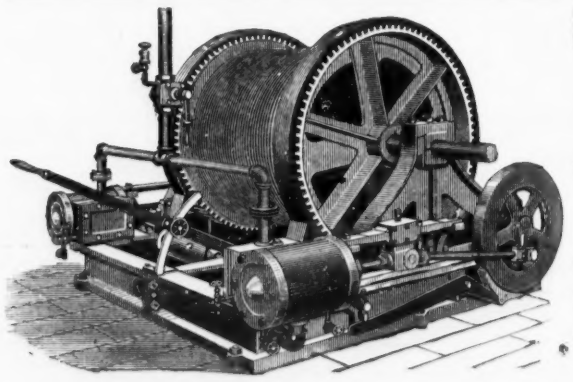

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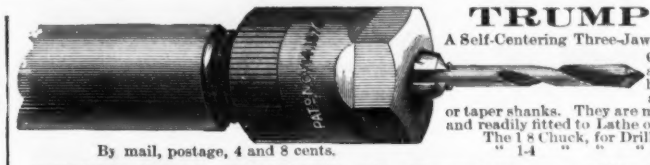

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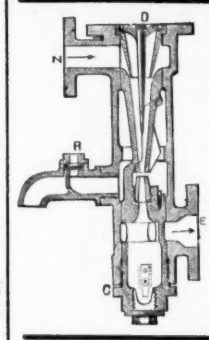

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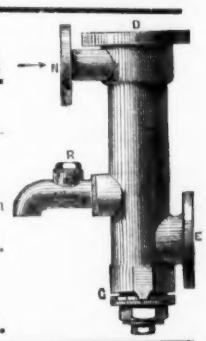

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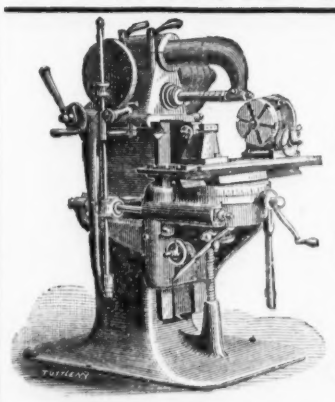

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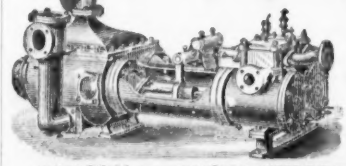

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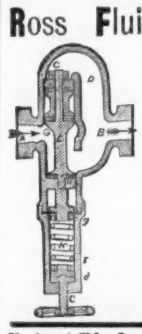

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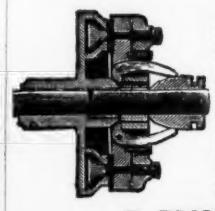

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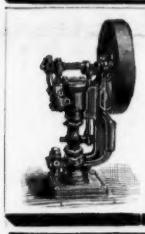

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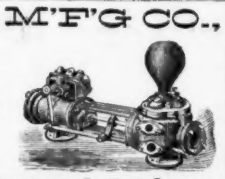

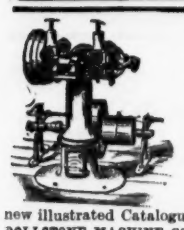

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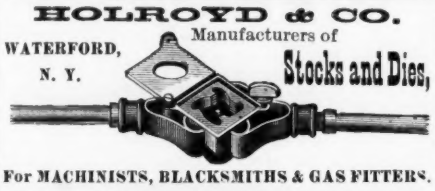

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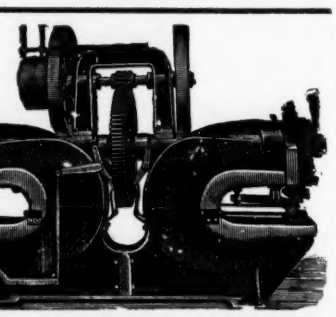

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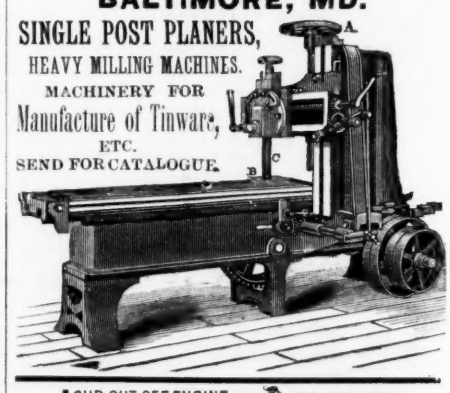

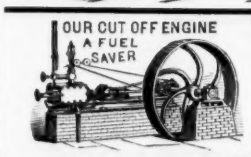

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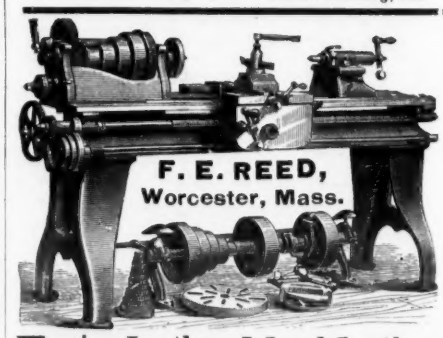

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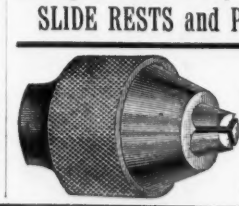

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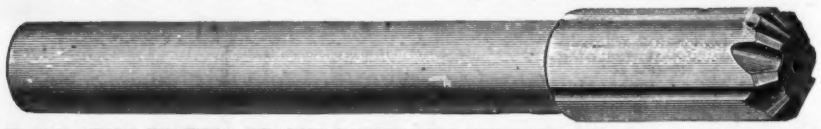

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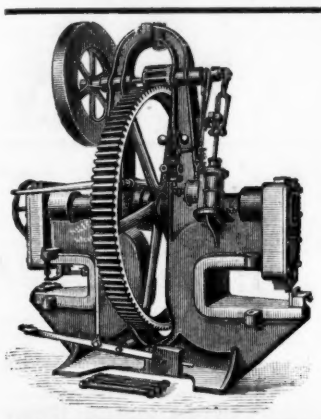

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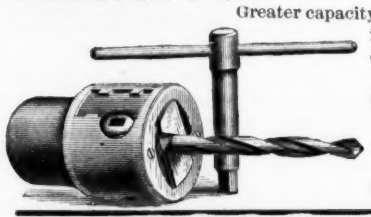

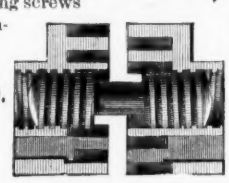

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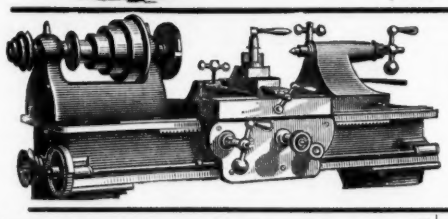

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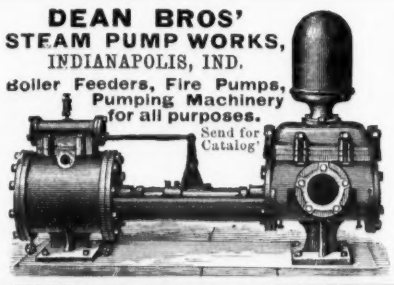

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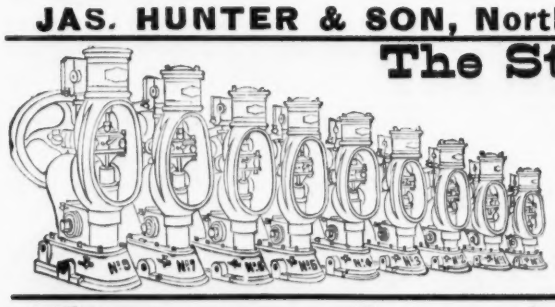

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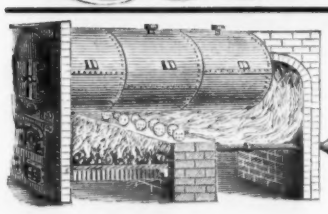

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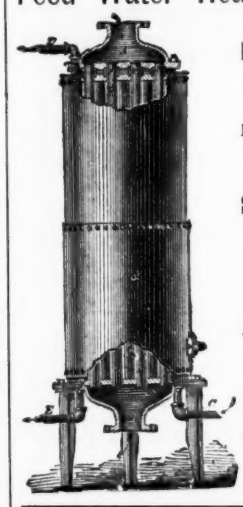

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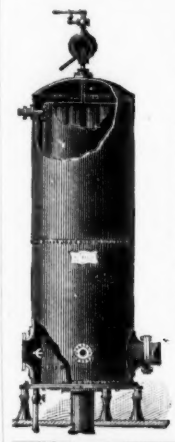

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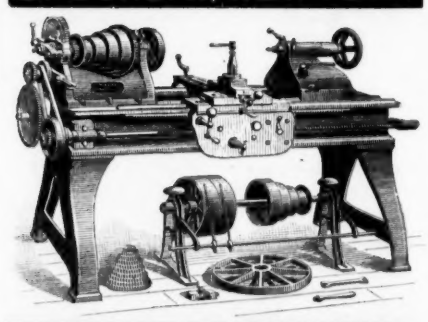

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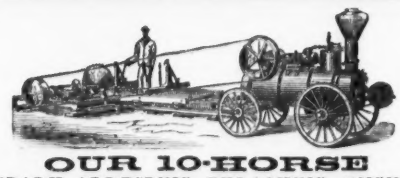

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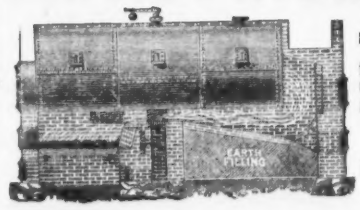

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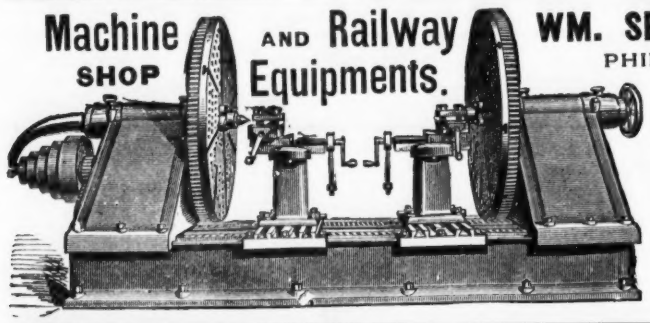

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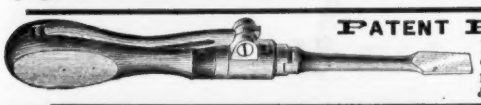

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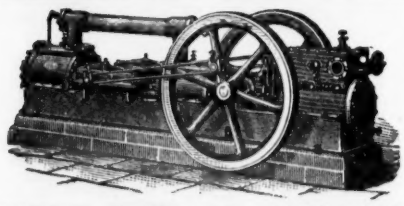

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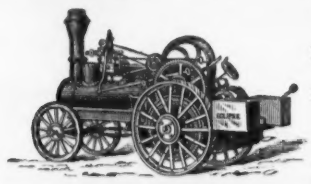

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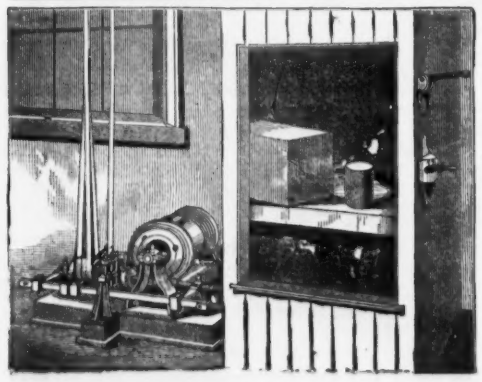

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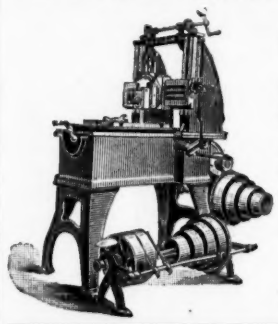

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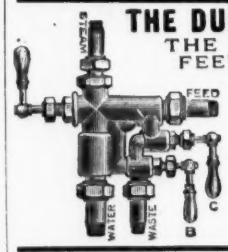

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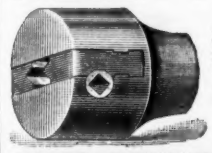

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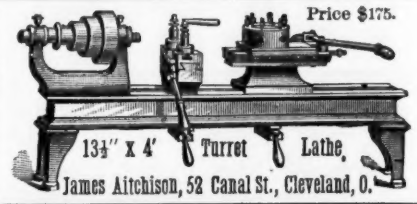

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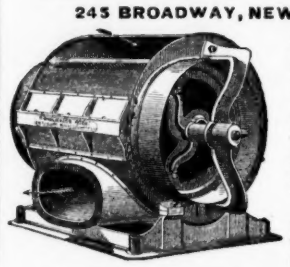

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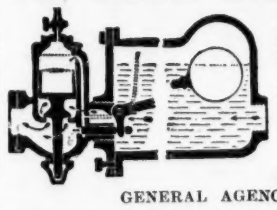

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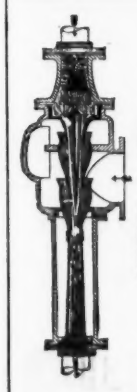

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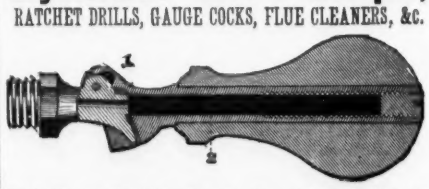

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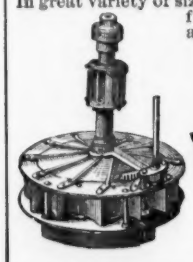

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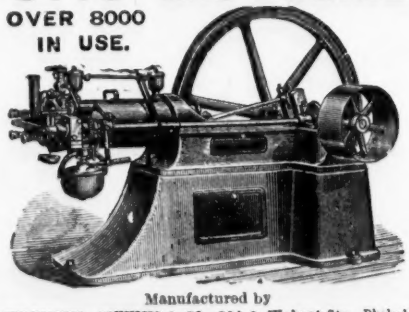

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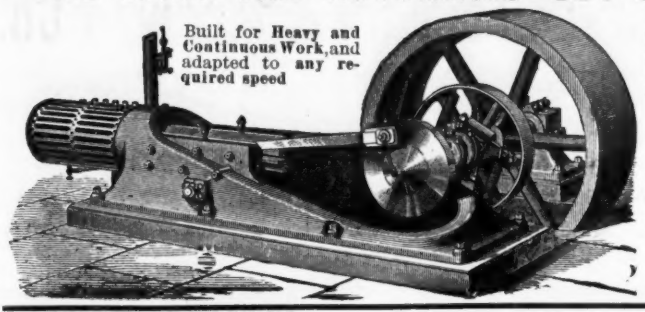

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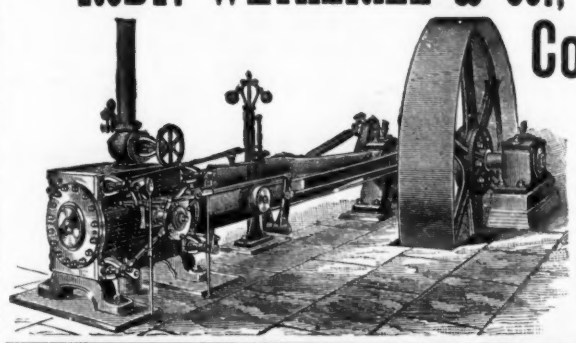

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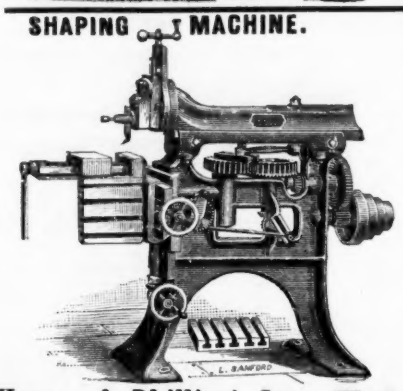

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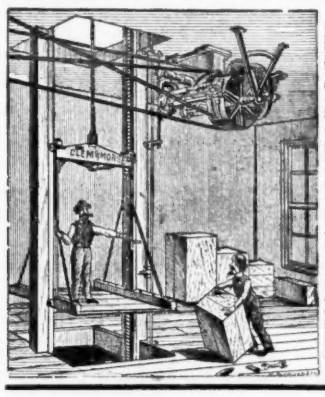

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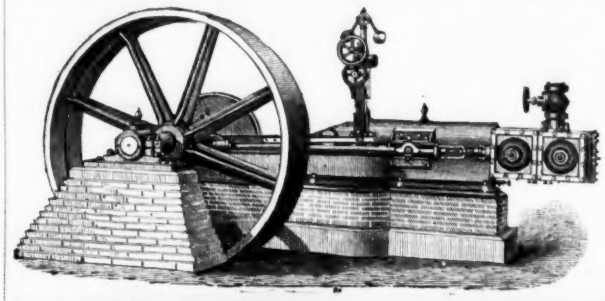

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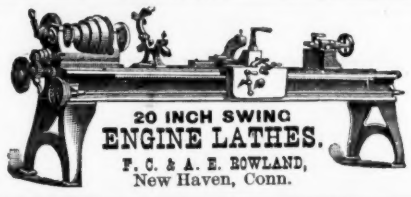

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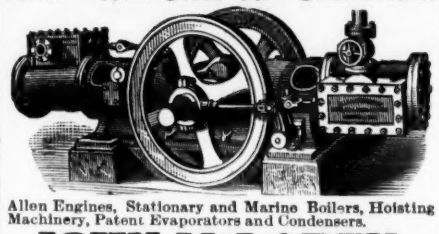

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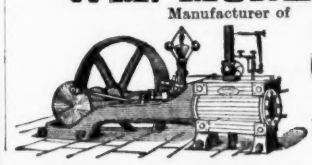

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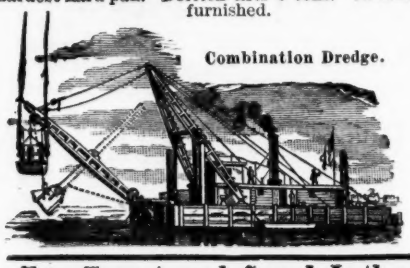

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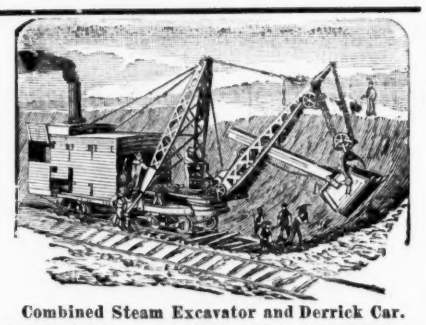

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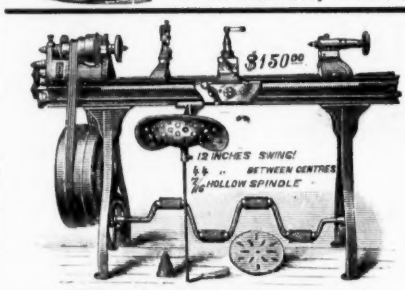

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1 36 " 22½ " " "
2 26 " 22 & 16 " " "
Lot other sizes, both new and second-hand.
1 Iron Planer, 54 inch x 42 inch x 17 feet.
1 " " 42 " 42 " 17 "
1 " " 36 " 36 " 13 " New.
1 " " 36 " 36 " 9 " "
1 " " 36 " 36 " 9 " Nearly New
1 " " 32 " 32 " 9 " " "
1 " " 24 " 24 " 6 " New.
Lot other sizes, new and second-hand.
1 38 inch Universal Radial Drill. New.
1 each, 40 inch and 48 inch Radial Drills, New.
1 48 inch Horizontal Boring Mill. New.
1 12 inch Stroke Slotter. New.

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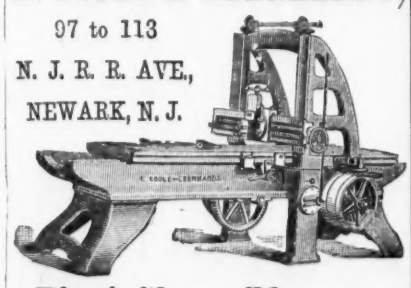

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18 x 18 x 3 feet	Weight,	2050
18 x 18 x 4 "	"	2,250
22 x 22 x 5 "	"	3,600
26 x 26 x 6 "	"	5,800
26 x 26 x 8 "	"	6,400

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The following New and Improved Machinists Tools are part of what we have for early delivery

1 42 in. swing 20 ft. bed. Engine Lathe. Feb. 15,
1 42 in. " 16 ft. " " " " 15,
1 36 in. " 18 ft. " " " " 15.
1 36 in. " 16 ft. " " " " 15.
1 New Corliss Engine, 16 in. x 42 in. Complete in four weeks. The following on hand:
1 New Corliss Engine, 12" x 36". Complete.
1 " 26 in. swing, 12 ft. bed, New Engine Lathe.
1 each, 30 in. " 14, 16 & 18 ft. bed. " "
1 60 in. swing, 24 ft. bed, New Engine Lathe.
2 22 in. " 12 ft. " " " "
2 19 in " 10 ft. " " " "
4 18 in. " 8 ft. " " " "
5 15 in. " 6 ft. " " " "
1 10 in. " 5 ft. " " " "
1 30 in. " 12½ ft. " " " "
1 26 in. swing, 14 ft. bed. " " "
1 12 in. swing, 6 ft. Hand Lathe.
1 10 in. " 4½ ft. Bed Hand Lathe.
1 54 in. x 16 ft. Iron Planer. Second-hand.
1 38 in. x 12 ft. " " New.
1 32 in. x 8 ft. " " "
1 26 in. x 6 ft. " " "
2 30 in. x 8 ft. " Planers. "
2 22 in. x 4 ft. " "
2 38 in. Swing Upright Drills. B. G. & S. F.
1 23 in. Drill. B. G. & S. F.
1 22 in. " Upright Drill. B. G. S. F.
1 23 in. & 3, 20 in. Drills. Plain.
1 18 in. Bench Drill.
1 each, 3 & 4 Spindle Drill.
1 Double Nut Tapper. Horizontal.
1 12 in. stroke Slotting Machine.
2 each, 12 & 15 in Shapers.
2 12 in. stroke Shapers, traveling head, 40 in. traverse double tables.
2 4½ in. Hyde's Pat. Centering Machines.
1 6 in. stroke Hand and Power Shaper.
3 Wood's Patent Bolt Cutting Machines to cut from ½ in. to 2 in. inclusive.
Second-Hand.
2 4 Spindle Drills, 1 Face Milling Machine.
1 Pond's Double Miller, 1 Screw Head Slotter.
1 No. 1 Brown & Sharpe Screw Machine.
1 Bolt Pointing Machine.
1 Emery Grinder, for 10 in. Wheels.
2 Double-Acting Presses. 4 Single-Acting Presses.
90 Foot Presses. 1, 00 Fowler Press. 1 Foot Punch, with bench. 1 Railway Saw Bench.
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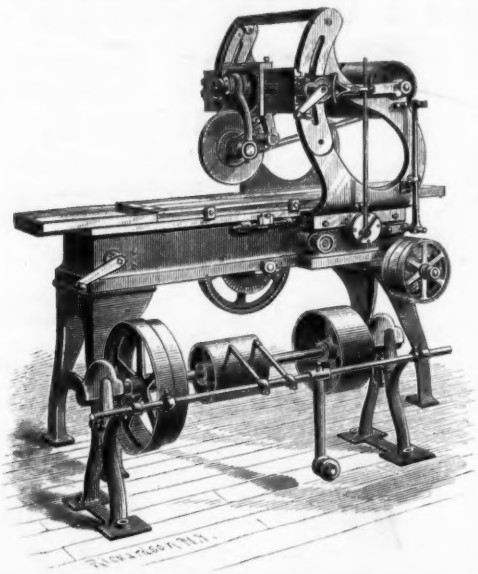

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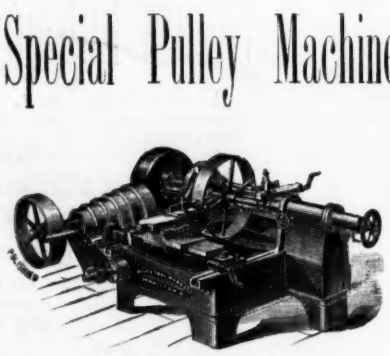
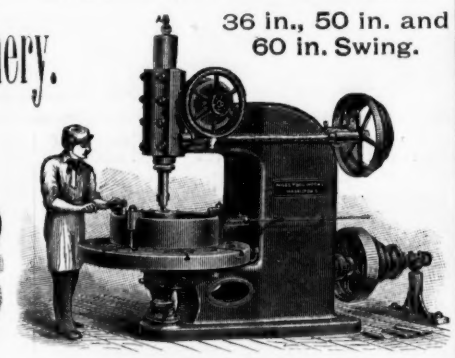


Pulley Lathe.



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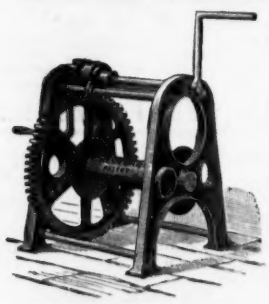

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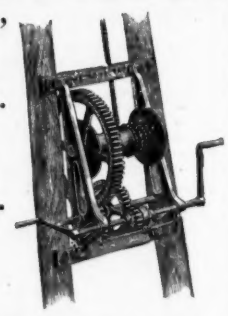

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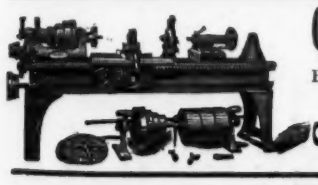

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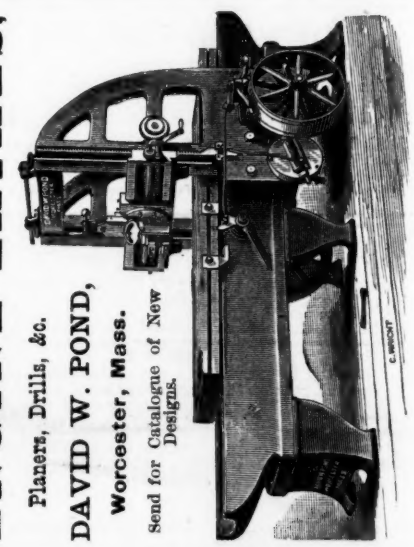

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